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THE AMERICAN CHEMIST AND THE WAR'S PROBLEMS[1]

A VOLUME could be written upon this subject if one possessed the power to assemble the material. The new problems which have arisen; the old ones which have become acute because of changed conditions; the splendid way in which the problems have been met where they were a matter of invention or skill; the new methods and processes which have sprung up as though born fullgrown; the many old ones which have been improved, altered and utilized in new connections; the way in which the chemists of the country have risen to emergencies which have compelled them to manufacture products in whose manufacture they had had no prior experience, would easily fill entire chapters in such a volume. Even so, no earthly progress, achievement or consideration can lift the pall which settles over us when we permit our minds to dwell upon the spectacle of this war. And whose mind can be diverted from it for any length of time? He must indeed exist far below the kindling-point who does not resent and despise with all his soul the philosophy and ideals which made it possible. It would be out of place therefore to consider our subject from the point of view of achievement, or felicitation, on any alleged good which has come to the science of chemistry because of the war. Surely no one would want progress at such a cost to his fellow man. We approach the subject rather in a spirit of thankfulness that we have been enabled to

[1] Address before Section C, American Association for the Advancement of Science, Columbus meeting, December 30, 1915.

save something out of the wreck, and that our experience had prepared us in advance so that we have been enabled to prevent the collateral business and economic tragedies of the war from spreading universally. It is not in any spirit of gladness, therefore, at the evil providence which has fallen upon our European neighbors, that we recognize that this war has exalted the importance of chemistry in the minds of those who had not much opportunity hitherto to appreciate its value, nor is it with any jubilation that we take pleasure as chemists in meeting our new problems and emergencies arising from the war.

The satisfaction to many industrial chemists in the last two years of being able to contribute to the solution of these problems and of being conscious of the salvation of many businesses from financial ruin through the exercise of their chemical experience, has seldom been so widely distributed as it now is. What an inspiration it would be to read, spread out upon the pages of such a book as we have mentioned, the chemical successes, big and little, of the past two years. It is not likely that many of them will be known for a while because of the fact that business caution forbids their publicity in many cases, and the vigorous campaign of destruction of equipment and diversion of supplies which stops at nothing which will hamper export from this country, makes silence a necessity in self-defense.

The problems of the war are of two kinds, those due to changed conditions and those arising from supplying munitions at high speed. Among the former are changes in raw materials made necessary by the failure of imports or by unusual consumption of raw material in other channels such as for products not heretofore manufactured in this country to the extent made necessary under present war conditions. These changed circumstances were also due in part to new demands for materials and products, which have arisen in the complete rearrangement of things that has come about in many circles since the war began. The other line of war problems which have arisen, those directly connected with munitions supply, are frequently of a difficult nature. All these various problems, however, have been met in practically every case with a degree of success which has surprised even ourselves.

Naturally one of the first serious effects of the war on American industries was the stagnation produced by the enforced cessation of exports in various lines. Such things as rosin, turpentine, petroleum products, acetate of lime and methyl alcohol were seriously affected for a varying length of time. Then the demand for munitions became, for instance, the wood distillation industry's salvation and, with great celerity, acetone plants were attached to many of the works of this industry and the high prices which the products of the industry demanded have brought unprecedented prosperity to it and have correspondingly hampered progressive improvement. Production, not efficiency, is at present the slogan for this and many other industries. Set-backs of the nature cited usually take time for readjustment and frequently the chemist is a material factor therein. The producer himself is often compelled to add the next manufacturing step to his own operations. The acetate maker, for instance, tends to enter acetone manufacturing. Where the new demands were ample, these attempts have succeeded and the war's conclusion will find an increased tendency to manufacture at the source.

The set-backs to industry arising from the disturbance in exports, while they were important financially, were minor matters compared with those arising from such

changed conditions as failure of raw materials or their curtailment by absorption in new or abnormally expanded industries. It is here that the chemist is needed most and it is here that he has been of immeasurable service, and has met the problems that have arisen in wonderful style. He was seriously hampered at first by the uncertainty as to the facts. The fundamental thing in every industry is the market. At first much damage was wrought and delay produced by false reports as to stocks on hand and supply, particularly, of imports. Much withholding of goods for higher prices was practised and even yet the pirates of commerce seek ways and means of evading contracts, even on deliveries of goods which they were receiving without cessation, so as to avail themselves of the inflated market prices. Some clever work by consumers trapped at least some of these unscrupulous brokers and sellers. All manner of fictitious prices were demanded of those unfamiliar with the facts and attempts were even made to influence the Washington government to activity against the British blockade through the use of untruthful statistics regarding dyes.

As soon as the true status of market and supply became reasonably certain many changes were effected which will give gradual, and probably ultimate relief. On every hand we see chemical activity without end. Products like synthetic phenol and barium salts not made in this country before the war are now made in large amount. Great expansion in production has taken place in the case of such material as benzol, toluol, aniline products, naphthaline, carbon-tetra-chloride, acids, alkalis, chlorates, bichromates and even oxalic acid. With all of these we were largely or in part dependent on imports, but have almost ceased to be so since the war began. Fertilizer plants erect their own sulfuric-acid works and insecticide makers their own arsenic-acid plants. Textile mills make their own bleach. Numbers of manufacturers replace potash compounds by sodium compounds and, to my own surprise at least, often with great improvement in results. The ceramist is rendering this country less and less dependent upon imports in that field by scientific purification and utilization of domestic clays. Manufacturers of numerous miscellaneous chemicals and pharmaceutical preparations proceed to refine and produce their own crude raw materials and intermediates. The dye famine—for it is real in certain quarters—stirs up corporations with capital of hundreds of millions to enter the field. One of these new companies has installed half a million worth of machinery in the last few weeks. Indigo and other dyes are being made in nearly half-ton batches which will soon expand to several ton size. Where formerly was the most peaceful of occupations, even fertilizer manufacture, every effort now goes to the making of munitions. New plants spring up at the beck and call of the new conditions such as the world has never seen. Think of a battery of one hundred nitric-acid stills each charging 4,000 lbs. of sodium nitrate three times a day. Think of the sulfuric acid required and the nitric acid produced. Think of the fact that this one of a number such (the largest nitric acid plant in the world, it is said) is a plant which a year ago did not exist except in the minds and plans of a group of chemical engineers. How little are we able to comprehend the reality of producing 1,000,000 pounds per day of gun-cotton where a year ago was merely pine-woods. What does it mean with reference to design of plant, erection and operation to any one who has not managed chemical engineering operations, to recount the engineering operations in-

volved in this enormous production of gun-cotton in a single plant?—work that is conducted in ten to fifteen parallel procedures or "cotton-lines," which with their accompanying accessories, include cleaning and alkali digestion of the cotton; bleaching with chloride of lime; manufacture of sulfuric acid for the production of nitric acid and "mixed acid"; nitration of the cotton in thirty-pound batches; the hazardous wringing and hasty submerging of the cotton in water, to avoid the consequences of heating by too slow dilution of the strong acid held spongelike by the cotton; the conveying of this material in the cotton-line to the washers where the remaining acid in the tube-shaped cotton fibers is removed; and finally the removal from the water as wet or damp gun-cotton, the commercial product of many plants. This end product of course is but the beginning or raw material for the various nitro-celluloses, smokeless powders and other high explosives. Yet this scale of operations is not going on in just one plant of this kind or even in this one industry. *This* is a sample of what is happening every day in the shape of the American chemical engineers' answer to the question, how are you meeting the war's problems?

At some of these things we are permitted to take at least a peep. No one man can know all of even such gross developments, and practically every chemist we meet has his enthusiastic story of the progress in his own and familiar fields. We all do know, however, that if this is the character of the outward developments, there must be legions of quiet research and other experimental attacks on the new problems, and literally hundreds of solutions being worked out for minor problems in factory and plant, not to speak of the vast amount of work in other departments of chemistry made necessary by all these things. Then, too, there is the ever verdant crop of interesting suggestions, revolutionary changes and inventions throughout the list of the chemical industries. In fact they are doubly numerous and aggressive under the stimulation of such a time as this. It is never wise to predict their success or failure until even years have elapsed in many cases. So that the lecturer who wishes to entertain his hearers with pleasant and surprising intellectual gymnastics in the shape of the newest and most wonderful achievements in industrial chemistry is safe from apparent error for from three months to three years, if he picks his illustrations well. At the end of that time he can dodge criticism for misjudgment by referring the back-fires to poor business management, insufficient capital, tariff, trusts and sometimes to poor engineering. It is true that a large number of these new things *never* make good. It is equally true that some of them will make good and that all of them indicate progress, for they are strivings, and progress comes by striving.

It is equally true also that many of the chemical expedients which are in successful use under war conditions will automatically step aside when normal conditions resume. It is fundamental industrial chemical intelligence that a procedure which is ridiculous under some conditions may be a God-send under others. We do not expect every change installed to be really normal progress, for it will not be so in the ordinary sense at least. On the other hand, it would be wrong also to say that the mushroom plants producing munitions are not signs of progress. They unquestionably are not such signs in as far as they are temporary. They do not measure true expansion in their respective fields. He would be a novice or singularly blind, however, who did not see that the construction of such plants on the undreamed-of scale I

have already mentioned, not to talk of the new materials and procedures which have been incorporated into many of them, makes for greatly enlarged experience in chemical engineering designing, construction and operation. It is easy to see the pressure these things are going to exert upon the future development of American chemical industries. The American chemist's experience is becoming greatly expanded and the significance of this is apparent when we consider that engineering progress is a function of demand, and skill or experience in solving problems. The demand increment is ever expanding with the development of the country. In addition the skill acquired in the production of munitions is a valuable potential asset for defense should such a necessity ever arise. Such preparedness is highly to be desired. Then too at the close of the war when the output of these plants is no longer needed for that purpose, their equipment and intelligence will be directed into whatever field promises most. Already some of these concerns are assured that some of their products will find a continuous demand after munitions manufacturing ceases, which will be some little time after actual hostilities are at an end. The field of dye production is already attracting some of them. Without doubt the industrial rearrangements to follow the war will leave us much better situated in our ability to cope with the problems of chemical production. At any rate, powerful financial interests will attack these problems as they never have been attacked before. These interests will constitute another great force, which will be particularly effective after the war. When they seek new outlets for materials such as alcohol, benzol and acids, whose production they are greatly accelerating at the present the gasoline and other problems will be greatly affected. These interests will be found after the war lined up behind the industrial chemists who have been struggling for years against all kinds of unfair competition and disreputable depreciation. Then again, any change in process, be it ever so time-worn chemistry or transient in its nature, if it actually is put into successful operation under the then existing conditions, must of necessity push out the boundaries of experience to greater and greater distances and make us better able to meet the problems of the future. Chemical engineering is like any other division of engineering, it grows by what it accomplishes. In this proof of ability to meet a transient emergency the American chemist is certainly reaping a hundredfold, from his unadvertised care in the meeting of his industrial problems of the years which have gone before. Individual cases of progress and development which I have mentioned, it is easily seen, are rarely of great importance in themselves. We have not been revolutionizing on a great scale nor have we been jumping at once into great new national industries, but we are rather directing the normal steady gait of our progressive industrial development with keener perception toward more complete self-containedness, and thorough industrial preparedness. Some of the industries mentioned which receive much public attention are of relatively little importance compared with many other items affected. The dyestuff shortage appears to annoy many, but the complaint is out of all proportion to the facts and the damage done, compared with that of other commodities. We import normally, for instance, $9,000,000 in coal-tar dyes per annum and if we should make them all ourselves—which we shall only gradually approximate—we should only increase our chemical manufactures two per cent. and

our total manufactures five one-hundredths of one per cent.

Though we have made reasonable headway on our problems we are keenly aware that much remains to be done. We do not expect to set the market right in the dye or other matters in a year or two. These developments take time and have always taken time. Neither should we deceive ourselves or the public into thinking because of what we are doing that we could turn out without the most careful and detailed previous planning, adequate munitions for our own defense "in sixty days" to supply the "two million men who would spring to arms" as we so often hear would happen in that undesired emergency.

It would be interesting to discuss in detail some of the transient as well as probably permanent advances, where they happen to be a matter of personal knowledge, if it were wise to hand information to the assassins who lie in wait to hamper some of them, for military reasons. It might be well therefore to spend just a little time in emphasizing some general considerations which are connected with this subject.

There is little use in attempting to disguise the fact that the present war is a struggle between the industrial chemical and chemical engineering genius of the Central Powers and that of the rest of the world. Quite irrespective of the war's origin, aims, ideals or political circumstances, these are the cohorts from which each side derives its power.

When we consider the strategic position of the Central Powers themselves, their capable education and training, their system of government, which, no matter what we may think of its selfish effect on the world as a whole, we must admit makes for more effective concentration upon its own governmental objectives, among which preparation for war is merely one of its manifestations—when we take into account all these things it must often appear to us that the greatest outstanding feature of the past two years is the miracle of the Entente Powers' resistance to the terribly efficiently prepared onslaught of the Central Powers. This resistance is due, to an extremely large extent, to the efficiency of the chemists of the neutral and Entente nations. The chemists of the Entente Powers and of America have arisen to the emergency as no chemists have ever done before in the history of the world. Confronted at the beginning of the war by antagonists whose munitions industry for years had been developed for just such a contingency, these chemists have in less than two years built up a rival industry at least as strong. Plant after plant has sprung up of such perfection of design and operation that one wonders how the mind of man was capable of such engineering. Though the speed with which these new and unexpected problems have been solved may appear surprising, no one who is informed about the progress and development of industrial chemistry in this country, could have reason to doubt that American chemical engineers and industrial chemists would rise to any emergency which it was within human power to meet. They have already and will continue to live up to what we have a right to expect of them, in view of their past successes. We should be surprised if a similar degree of success did not crown the efforts of the chemists of the other countries, France, Britain, Italy, Germany, Austria, Russia, for it has never been the habit of American chemists to boastingly claim superiority because of any advantage, real or imaginary, with which they, like any group, are apt to be blessed for a greater or less period of time. We have always appreciated chemical contributions to progress from whatever source they have come

and praised unstintingly the individual wherever he may be who has taken a distinct step forward, for we firmly believe this is an important help in advancing the progress of the science.

These general developments are naturally not a matter of public information, except attention is called to them. The chemist works almost entirely beneath the surface of things and only in a few spectacular cases is public attention drawn to his work. It is quite natural, therefore, that appreciation and praise of foreign chemical achievement and particularly our consistent praise of German achievement to our students by our university teachers of chemistry have been misunderstood, and have prepared a fertile field for foreign propagandas to establish a false impression of the superiority of certain groups of foreign chemists. We should scarcely object to a good-natured adulation of any one's fatherland and its achievements. Such things always contain good and are stimulating to every one, and it is a pleasure to hear them when free from arrogance, even when the adulation contains little that is new or even strictly true. When, however, this privilege is abused so that the point of superiority must be made by depreciating American efforts it has a vicious positive result upon the minds of the uninformed, and at times causes great financial loss to them.

If the shortcomings of American chemistry were frankly discussed and compared with foreign successes in a chemical publication, some help might thereby be given to those who could derive benefit from it. When this is *not* frankly done, but simply issued as an incidental *depreciation* of American chemistry, particularly when discussing foreign chemical achievement, and still worse when in a non-chemical publication, the object can scarcely be rated as creditable.

A good illustration of this is an article published by the *Review of Reviews* for August, 1915, upon "What German Chemists are Doing to make Germany Self-sustaining," by Hugo Schweitzer, who, the editor humanely states, is an American chemist. Considering the avowed purpose of the article as attempting to influence American public opinion to stop "*all* exports to *all* belligerent nations," the article gives an interesting appreciation of the German chemist's efforts to meet their present problem, but commences to wind up as follows.

> Thus the horrors of war, through the ingenuity of the German chemists, are promoting the legitimate industry of the nation, rendering it more and more independent of foreign conditions, and keeping in the country vast sums formerly spent for imports. *Unfortunately and unexpectedly we can not record similar advantages for the United States, although we are enjoying peace.*

The inaccuracy of the last statement we hope is no measure of the truthfulness of the article as a whole. If the myth of the overwhelming industrial chemical superiority of German chemists ever was really believed, in that country, the military forces of the Central Powers at least must marvel at the reason the supposedly inferior foreign industrial chemists have been able to display such astounding ability and speed in meeting the problems of munitions production, particularly too in countries where governmental mobilization of industries was unknown before the war and, in America at least, still is unknown. At any rate, it has become evident that lack of advertisement is no sign of lack of ability or activity, and that ability to handle science skillfully and powerfully is not confined to any race or nation. We do not feel that there is much to be gained by confuting claims of the chemical superiority of foreign countries in this and other similar articles, for it is curious how this war has developed

foresightedness to the extent that such *Americans* can see only the chemical develments abroad.

I hope I have made it clear that it is the abuse of a privilege against which I speak, and not against individuals, for we do not let such personal attacks affect our regard for individual Germans any more than we allow our opinions on the history of the past two years to affect this regard for such individuals. Every one of us know Germans who are the most whole-souled and kindly men—who we are grateful to know and who scorn to be guilty of, or to take advantage of, such chauvinism. Such depreciations of American efforts will bury themselves, without any assistance from us, and I only emphasize them here to call attention of teachers of chemistry to the fact that *we* owe protection to the business community and the public against such misrepresentation. We should never cease our appreciation of foreign chemists of whatever nation, but in addition it is our duty first to inform *ourselves* and then our students upon what our own chemists have done to solve our problems in this country. We have been able to blame our shirking this duty in the past upon the fact that it was easy to get information about foreign chemical achievement and no one seemed anxious to give publicity to American development. We as teachers have certainly done little to remedy this condition. The American Chemical Society, however, has spread the results of American effort before us and made them accessible in its *Journal of Industrial and Engineering Chemistry* for the last two years, in the shape of a series of addresses on the chemist's contributions to American industries. There are other addresses in these same volumes profoundly informing along these lines and this is particularly true of the Perkin Medal addresses each year in the same journal. In addition Professor S. P. Sadtler in the *American Journal of Pharmacy* for October, 1915 (an address before the National Exposition of Chemical Industries), in giving popular information along this line limits himself entirely to chemical industries *originated* as well as developed by American chemists, and Edgar F. Smith's "History of Chemistry in America," but recently issued, should be read by every student of chemistry.

None of this work is in any sense a vainglorious adulation of the chemist as some superbeing nor is it an attempt to compete in the questionable game of lauding one nationality above another. It is merely a matter of a belated form of education which our universities and chemists hitherto have largely denied to the American business man, and which he has a right to expect of them. The record is one for which we have good reason to be thankful and, as we teachers no longer have the excuse of ignorance about American progress, we are at fault if the rising generation has not an appreciation of the progress of chemistry in America, commensurate with the high level of its development.

In conclusion then, let us take courage from the fact that though much damage has been done to us and our industries by the war, our efforts at salvage benefit us as experience, power and preparedness. We have seen that the chemists of America have met the war situation well and do not require defense at the hands of any one. It becomes increasingly evident that business is awakened to the value of chemistry as a source of power and wealth as business has never had occasion or opportunity to be hitherto. Let us hope also that not only the spectators, but also all the combatants may learn, even if impelled by bitter war's experience, to appreciate the worth, each of the other, and that all nations are "made of one blood to dwell on the face of the earth."

James R. Withrow

DEATH RATES AND EXPECTATION OF LIFE

DIRECTOR SAM. L. ROGERS, of the Bureau of the Census, Department of Commerce, is soon to issue a unique set of tables, the first of their kind which have ever been prepared by the United States government. These tables, which were compiled in the division of vital statistics, under the supervision of Professor James W. Glover, of the University of Michigan, show death rates and expectation of life at all ages for the population of the six New England states, New York, New Jersey, Indiana, Michigan and the District of Columbia (the original death-registration states) on the basis of the population in 1910 and the mortality for the three years 1909, 1910 and 1911. They are similar to the "life tables" prepared by life insurance companies, but differ from them in that they relate to the entire population of the area covered, whereas the life insurance tables relate only to risks selected through medical examination and otherwise.

Expectation of life, at birth, in a stationary population—that is, one in which the births and deaths were equal and were the same from year to year, and in which there was no immigration or emigration—would be the same as average age at death, which is calculated by totalizing the ages of all deceased persons and dividing the result by the number of deceased persons.

According to these tables the average expectation of life, at birth, for males is 49.9 years; for females, 53.2 years; for white males, 50.2 years; for white females, 53.6 years; for native white males, 50.6 years; for native white females, 54.2 years; for Negro males, 34.1 years, and for Negro females, 37.7 years. Females are thus longer lived than males to the extent of more than 3 years, and in the case of the native whites and Negroes, more than 3½ years.

The expectation of life at the age of 1 is considerably greater than at birth, being 56.8 years for native white males and 59.5 for native white females, and reaches its maximum at the age of 2, when it is 57.5 for the former class and 60.1 for the latter. At the age of 12 the average native white male's expectation of life is 50.2 years; at 25 it is 39.4 years; at 40, 28.3 years; at 50, 21.2 years; at 60, 14.6 years; at 70, 9.1 years, and at 80, 5.2 years. Similarly, at the age of 12 the average native white female's expectation of life is 52.6 years; at 25 it is 41.8 years; at 40, 30.3 years; at 50, 22.8 years; at 60, 15.8 years; at 70, 9.8 years, and at 80, 5.5 years.

A part of the difference between expectation of life for men and for women is due to the greater number of violent deaths among men. Nearly four fifths of these violent deaths—suicides, homicides and accidental deaths—are of males, and such deaths form about 7 or 8 per cent. of the total number occurring each year. This fact, however, does not account fully, or even in major part, for the greater longevity of women. An examination of the tables discloses a lower death rate for females than for males during each of the first 12 months of life and, in the case of the native whites, during each year of life up to the age of 94. During the first month of life the death rate among native whites is nearly 28 per cent. higher for boys than for girls, and during the first year it is more than 20 per cent. higher.

The enormous waste of infant life which still goes on, although medical science has done and is doing much to arrest it, is shown by the exceedingly high death rates which prevail among infants under 1 year of age. Of 100,000 native white boy babies born alive 4,975, or almost 5 per cent., die during the first month, and 12,602, or 12.6 per cent., die within one year. The girl baby's chance of life is considerably better, the death rate among native white females during the first month being 3,894 per 100,000 born alive, or less than 4 per cent., and during the first year 10,460 per 100,000, or nearly 10.5 per cent.

On its first birthday, however, the likelihood that a child will die within the year is only about one fourth as great as it was at birth, the death rate among native whites during the second year being 2,841 per 100,000 for males and 2,610 per 100,000 for females. The

rate continues to decrease until the twelfth year of life—that is, the period between the eleventh and twelfth birthdays—during which it is only 228 per 100,000 for males and 198 per 100,000 for females. This, the figures indicate, is the healthiest year of life among native whites. Thereafter there is a continuous increase in the death rate from year to year. During the forty-eighth year of life, in the case of native white males, it is 1,267 per 100,000, or almost exactly what it was during the third year, 1,266; during the sixty-second year it is 2,919 per 100,000, or a little more than during the second year, 2,841, and during the eightieth year it is 12,184, or somewhat less than during the first year, 12,602. Similarly, among native white females the rate during the fiftieth year, 1,120, is a little less than during the third year, 1,144; during the sixty-third year it is 2,548, or somewhat less than during the second, 2,610, and during the eightieth it is 10,901 per 100,000, or a little more than during the first, 10,460. The native white man at the age of 102 and the native white woman at 99 have approximately the same prospect of dying within one month that they had at birth.

To say that a person's expectation of life is a certain number of years is not the same as saying that he has an even chance of living that number of years. This is because, as already explained, expectation of life represents the average remaining length of life, at any given age, in a stationary population, whereas an average person in a given group has an even chance of living to what is called the median age at death, that is, the age below which half of the members of that group will die. The median age at death for all native white males in the assumed stationary population would be 60; that is to say, of a given number of such males born alive, half would die before reaching 60 and the other half at 60 and beyond. A native white male child at birth, then, has one chance in two of reaching this age. At the end of his first year, however, he has a trifle better than an even chance of reaching 64; and at 42 he has one chance in two of attaining three score and ten. Similarly, a native white female child at birth has an even chance of living a few months past the age of 64; at the age of 1 she has one chance in two of living until she is nearly 68 years old; and at 22 her chance of reaching 70 is an even one. Thus a native white man at 42 and a native white woman at 22 have about the same chances of celebrating their seventieth birthdays.

The relative healthfulness of city and country is strikingly shown by the tables, according to which the death rate among white males under 1 year of age in cities having 8,000 inhabitants and over in 1909, and in cities of 10,000 and over in 1910 and 1911, is 13,380 per 100,000 born alive, whereas in smaller places the corresponding rate is only 10,326 per 100,000, or 23 per cent. less than the rate for cities. A similar difference prevails with respect to white females under 1 year of age, for whom the death rate in cities is 11,123 per 100,000 born alive, while in rural localities it is only 8,497 per 100,000, or 24 per cent. less than the urban rate.

For white males the expectation of life, at birth, in rural localities is 7.7 years greater than in cities; at the age of 10, 5.4 years greater, and until the age of 39 is reached there is a margin of more than five years in favor of the country. Thereafter the difference becomes gradually less, but is always in favor of the country until the age of 88 is reached, at and after which the cities show a slightly greater longevity than the rural localities.

For white females the difference between urban and rural longevity, while pronounced, is somewhat less than in the case of males. At birth the white female's expectation of life is 6 years greater in rural than in urban localities; at 10, 3.3 years greater, and until the age of 46 is attained the difference continues to be more than 3 years. Thereafter it declines until the age of 83 is reached, after which the cities have a slight advantage over the country.

THE IROQUOIS INDIAN GROUPS OF THE NEW YORK STATE MUSEUM

There have recently been opened for public exhibition in the New York State Museum six

life groups which have been erected for the purpose of portraying the aboriginal activities of the Iroquois, or the Confederacy of the Six Nations. The figures in these groups are life casts of the best types obtainable and each one is thus a somatic document. They have been reproduced by Caspar Mayer and Henri Marchand, sculptors. The background paintings, each 55 feet long, are of historic spots in New York Indian history, and they, together with the entire setting of the groups, are by David C. Lithgow, artist. The conception and execution of the groups and the accuracy of their composition are due to the director and the archeologist of the museum.

The groups are a gift to the State Museum from Mrs. Frederick Ferris Thompson.

Seneca Hunter Group.—With a background scene representing Canandaigua Lake and Genundewa, the sacred hill of the Senecas, in the distance, the group is that of the Seneca family clustered about the door-yard of their hunting lodge, each individual engaged in his allotted duties; the father bringing in a fawn from an early morning hunt, the mother busy skiving a deer skin, the daughter dressing and cutting venison; while the eldest son is a hunter and warrior and the younger son is cutting down a tree which obstructs the door-yard.

The Return of the Warriors.—The advance party of a Mohawk war expedition has returned to Theonondioga, the Mohawk capital, situated in 1634 just above the present village of Sprakers in the Mohawk valley, and the observer is looking north toward the foothills of the Adirondacks. The Mohawks have brought in two Mahikan captives from the vicinity of the Hudson River. The purpose of the group is to illustrate (1) the treatment of prisoners, (2) the authority of the Iroquois woman, who is by virtue of her tribal right interposing to save one of the captives from death, (3) the differences between the Mohawks and Hudson River Mahikans, (4) an Iroquois village with its stockade wall.

Council of the Turtle Clan.—The scene is laid within an elm-bark lodge typical of the habitation of the Iroquois before the coming of the whites. The figures are all Onondagas and the chiefs are engaged in trying out some important tribal subject. The one female in the group, not permitted by tribal usage to appear before the council on her own behalf, is urging her cause upon her secretary. The purpose of the group is to illustrate (1) one of the political units of the Iroquois Confederacy, (2) the interior and equipment of a bark lodge, (3) the four Turtle Clan sachems in council, (4) the method of recording by wampum the transactions of the council, (5) the privilege of an Iroquois woman to voice her opinions in the highest or lowest councils of the nation. Through the open door of the council house is a typical scene of the rough country in southern Onondaga County.

Cayuga False Face Ceremony.—This is the midwinter purification rite, when evil spirits are driven from all the houses of the Iroquois village. Grotesquely clad and masked medicine men burst into the cabins, throwing open the doors and windows, and scatter new ashes over the heads of the occupants. The Indian cabin is an old one, typical of the period of 1687–1850, when the New York Indians had become accustomed to traders' cloth and tools. The clothing of the figures, made of trade cloth highly embroidered by symbolic beadwork, the tools and other articles are all indicative of contact with the Europeans. The False Face Ceremony is one of the most spectacular rites common among the Iroquois. The figures are all life casts of Cayuga Indians and the view through the open doorway is of a moonlight winter's night on the frozen Cayuga Lake.

Typical Iroquois Industries.—This group depicts a company of Oneida Indians gathered in a sheltered spot in the woods near their capitol village on Nichols Pond, Township of Fenner, Madison County. This was the fort unsuccessfully stormed by Champlain in 1615. The arrowmaker in the center is telling an amusing tale while he chips his flints. About him are the basket maker and belt weaver, the wood carver, the moccasin maker and the potter, all engaged at their occupations as they

listen to the arrowmaker's story. The figures are casts of Oneida Indians.

The Corn Harvest.—This group depicts a harvest scene in the maize fields on the flats near Squakie Hill in the Genesee Valley looking south toward the High Banks of the Genesee River. With one exception the figures are all of women who are engaged in harvesting, braiding and pounding the maize and baking corn bread. The autumnal coloring is brilliant and the background very rich and effective. The figures are life casts of Seneca Indians.

SCIENTIFIC NOTES AND NEWS

The degree of doctor of laws has been conferred by Washington University on Dr. Theobald Smith, of the Rockefeller Institute for Medical Research.

At the commencement exercises celebrating the fiftieth anniversary of the founding of Lehigh University the degree of doctor of science was conferred on Joseph Barrell, B.S. ('92), professor of structural geology in Yale University.

The Paris Academy of Sciences has elected, as corresponding member in the section of medicine, Dr. Yersin, of Nha-Trang (Annam), former worker at the Pasteur Institute, known for his work in bacteriology, especially on antiplague serum.

The *Journal* of the American Medical Association states that ever since Professor Kitasato resigned his office as director of the Imperial Institute for the Study of Infectious Diseases, in consequence of the amendment of the imperial ordinance which took place quite against his and his followers' wishes, public sympathy has been aroused to help him in completing his new enterprise in establishing an institute, which was completed in December last. His services have been recognized by over 400 statesmen, business men and others of his native province, Kumamoto, who held a meeting on April 10, at which they presented him with a medal in order to express their recognition of his achievements in promoting bacteriology, public health and medicine.

We learn from the *Journal of Engineering and Industrial Chemistry* that Professor E. C. Franklin, of the Leland Stanford University, has had an unfortunate laboratory accident, through an explosion in his laboratory which caused burns and other injuries. Later news announces that he is recovering in the hospital and that the accident will not leave serious consequences.

Mr. Clyde H. Bailey, cereal technologist of the Minnesota Agricultural Experiment Station, has been granted a year's leave of absence to take up research work in the laboratory of the State Grain Inspection Department in Minneapolis.

Professor George M. Reed, of the department of botany of the University of Missouri, has been appointed research fellow at the Brooklyn Botanic Garden for the summers of 1916 and 1917, in place of Professor W. H. Rankin, of Cornell University, who was obliged to resign on account of a change in his duties at Cornell. The problem to be investigated is the diseases of the trees and shrubs of Prospect Park, which adjoins the Botanic Garden.

Dr. Martin B. Tinker, who was professor of surgery at the Cornell Medical College in Ithaca from 1903 till the second-year instruction was discontinued at Ithaca, has been elected to the presidency of the New York State Medical Society.

A cablegram has been received by the Museum of the University of Pennsylvania officials from Dr. William C. Farabee, leader of the university museum's Amazon Expedition, saying that he has sailed from Para, Brazil, and expects to reach Philadelphia about the middle of this month. Dr. Farabee is bringing the collections he has made in the last two years, those of his first year having reached the museum.

Professor Adolph F. Meyer, consulting engineer to the International Joint Commission, has just returned from the northern part of the state of Minnesota where he was called to investigate flood conditions prevailing on the Lake of the Woods watershed. Damage

from high water has been serious and widespread and the waters are still rising. Professor Meyer stated that if such regulation of these waters as the International Joint Commission will soon recommend to the government of the United States and Canada had been in force, most, if not all, of the damage could have been prevented.

A SECOND relief expedition is to be sent out from the American Museum of Natural History and the American Geographical Society in the hope of rescuing Donald B. MacMillan and the members of the Crocker Land Expedition sent out in 1913 by the American Museum of Natural History, the American Geographical Society and the University of Illinois. The party is believed to be several hundred miles northwest of northern Greenland. The first relief expedition is frozen in at Parker Snow Bay, 150 miles south of Etah. The second expedition will try to join forces with the first and then proceed to Etah. The steamship *Danmark* has been chartered for the trip, and the sum of $11,000 has already been pledged—$6,000 by the American Museum and its friends and $5,000 by the American Geographical Society. According to George H. Sherwood, assistant secretary of the museum, the members of the expeditions are in a serious plight, and there is urgent need of more funds to finance the new relief expedition.

A DESPATCH from Montevideo, dated June 6, states that a relief expedition for the rescue of the twenty-two members of Lieut. Sir Ernest Shackleton's Antarctic expedition left behind on Elephant Island will start immediately.

THE Bureau of American Ethnology of the Smithsonian Institution is manifesting considerable activity in archeological and ethnological research in the field at the present time. Mr. Neil M. Judd and Dr. Walter Hough have been temporarily detailed by the National Museum for the purpose of conducting archeological investigations in southern Utah and western New Mexico, respectively, and Dr. J. Walter Fewkes is engaged in work of a similar nature northeast of the Hopi villages in northern Arizona. Mr. John P. Harrington is devoting his attention to gathering the final material necessary to the completion of an exhaustive memoir on the practically extinct Chumash Indians of southern California; Mr. J. N. B. Hewitt is among the Iroquois of Ontario; Dr. Truman Michelson has resumed his studies among the Fox Indians of Iowa, and Mr. James Mooney has taken the field for the purpose of continuing his studies among the Cherokee of North Carolina. Mr. Francis LaFlesche has recently returned from a trip to the Osage tribe of Oklahoma after recording additional material pertaining to the sacred ceremonies of that people. Miss Frances Densmore will shortly resume her studies of Indian music in the field, special attention this summer being devoted to the Hidatsa Indians of North Dakota, while Dr. L. J. Frachtenberg is still engaged in studying the almost extinct Indian languages of Oregon.

AT a meeting of the Washington Academy of Sciences, on May 11, Dr. Erwin F. Smith, of the Bureau of Plant Industry, delivered an address on "Resemblances between Crown Gall in Plants and Human Cancer." This address will be printed in SCIENCE.

PROFESSOR ARTHUR B. LAMB, of Harvard University, lectured on "Induced Reactions," in the Havemeyer Chemical Laboratory, New York University, on May 12.

THE Halley Lecture at the University of Oxford was delivered on May 20, by Dr. G. W. Walker, late fellow of Trinity College, Cambridge. His subject was "The Measurement of Earthquakes."

DR. CHARLES B. ALEXANDER, of New York, a regent of the University of the State of New York, gave a dinner in Albany last week in honor of Dr. John J. Carty, president of the National Institute of Electrical Engineers, and Professor Michael Pupin, Serbia's Consul to this country and professor in Columbia University. The guests inspected the instruments contrived and used by Professor Joseph Henry while a teacher in the Albany Academy in making the first successful experiments on long-distance electric transmission beginning in 1827. Professor Pupin pledged himself to raise $15,000 if a like sum were raised to erect

a bronze statue of Professor Henry in the park in front of the school in one of whose rooms the great discovery was made. Dr. John J. Carty and Regents Pliny T. Sexton, Charles B. Alexander, Chester S. Lord, Abram I. Elkus, James J. Byrne, Adelbert Moot, William Berri and Albert Vanderveer each pledged $100.

Professor Karl Schwarzschild, director of the Astrophysical Observatory at Potsdam, has died from illness contracted while on military service.

The death is announced of Mr. John Griffiths, formerly tutor in mathematics and for many years past senior fellow of Jesus College, Oxford.

An appeal has been issued by the Chinese Medical Board to the medical profession of Philadelphia to supply fifty physicians and surgeons for immediate service at hospitals in China. It is believed that the furnishing of this unit will be undertaken by the College of Physicians of Philadelphia.

Invitations from the Kansas City Section of the American Chemical Society and from the University of Kansas to hold the spring meeting of 1917 in Kansas City, Mo., and in Lawrence, Kan., have been accepted.

A meeting for the reading of papers will be held by the Ecological Society of America at San Diego, in connection with the meeting of the Pacific Division of the American Association on August 9, 10 and 11. Two field excursions in the vicinity of San Diego will be held by the society on the succeeding days.

At the tenth annual meeting of the British Science Guild, held on May 17, the Right Hon. Andrew Fisher, high commissioner for the commonwealth of Australia, described the establishment of the National Institute of Science and Industry in Australia. Surgeon-General Sir Alfred Keogh, referring to the relation of science to the work of the Royal Army Medical Corps, said that in the British army in France there were twenty-two cases of typhoid fever and stated that under former conditions there would probably have been from eighty to a hundred thousand cases. Dr. R. Mullineux Walmsley, principal of Northampton Polytechnic Institute, E.C., spoke of the work of the technical optics committee of the guild.

On the occasion of his seventieth birthday on March 16, 1916, Professor G. Mittag-Leffler and his wife made a joint last will and testament of peculiar significance in the domain of science. Extracts from this will have recently been published by Professor Mittag-Leffler in a pamphlet, so that the features of the document are now public property. By the terms of the will there is founded a mathematical institute to bear the name of the donors, which institute is to be housed in their villa at Djursholm, Stockholm. The institute is to be fully established at the death of the donors, and is to consist of the villa in question, the mathematical library of Professor Mittag-Leffler, and a fund for the encouragement of pure mathematics, particularly in the four Scandinavian countries, Sweden, Denmark, Finland and Norway, but more especially in Sweden. The library is to be open to all mathematicians, subject to the approval of the president of the committee of trustees, or the director of the institute. Certain financial assistance is to be given to those who show genuine aptitude for research and discovery in the domain of pure mathematics. There is also provided for the bestowal of medals and of prizes in the form of sets of the *Acta Mathematica*. The institute thus becomes one of the most noteworthy establishments in the learned world, and will be a perpetual monument to the great interest in mathematics always manifested by Professor Mittag-Leffler.

The *Journal* of the American Medical Association states that the seventeenth annual meeting of the Kitasato Institute Alumni Association was held on April 3 and 4, and at the general meeting held on the afternoon of the second day the discoverer of the cause of infectious jaundice, Professor Inada, and his assistant, Dr. Ido, were awarded by Professor Kitasato the prize of the late Professor Asakawa fund. The prize consisted of a gold medal and a sum of money. It is offered for the best

work on bacteriology, parasitology, immunology and study of infectious diseases carried out and published in Japan during the preceding year. The work consisted of the discovery of the cause of the infectious jaundice, which prevails endemically not only in Japan but also in other countries. The causative agent has been discovered to be one of the species of spirochetes.

IN accordance with plans approved by Secretary of the Interior Lane, the investigation of the mineral resources of Alaska by the Geological Survey will be continued this year by 12 parties. Congress has recognized the necessity of preparing in advance for the survey of this difficult field by including the appropriation for its continuation in the urgent deficiency act, which was approved on February 28. This prompt action makes it possible to plan the work in advance of the opening of the field season and to carry out the plans efficiently and economically. The work to be done this year includes a detailed survey of the region tributary to Juneau, Juneau, which is the most important quartz camp in Alaska. A continuation of the study of the mineral resources of the Ketchikan district, where there are important gold and copper mines, is also planned. The investigation of the water powers of southeastern Alaska will also be continued. Only one party will be employed in the Copper River region. Two parties will work in Prince William Sound. Four parties will make surveys in the region directly or indirectly tributary to the government railroad under construction. One of them will study the new Tolovana placer district and also make some supplementary investigation of the Fairbanks lode district. The geologists of this party will later visit the Nome district. A detailed geologic survey will be made of the western part of the Nenana coal field, which is adjacent to the route of the government railroad. Two other parties will be employed in carrying reconnaissance surveys westward from the railroad route to the Kantishna placer and lode district. It is also proposed to make surveys of the lower Yukon, including the Marshall placer district.

IT is stated in *Nature* that at the recent annual meeting of the Paris Academy of Sciences, the president, M. Gaston Darboux, gave an account of the careers of men, for the most part young, to whom prizes of the academy had been awarded, but who have fallen in the service of their country. M. Marty (Francœur prize), killed September 10, 1914, at the battle of the Meuse, was distinguished by his contributions to mathematics. M. R. Marcelin (Hughes prize), killed near Verdun, in September, 1914. His work on kinetic physical chemistry was remarkable, both in theoretical treatment and on the experimental side. M. Marcel Moulin (Gaston planté prize), killed at the battle of the Marne, September 6, 1914, founded the Institute of Chronometry at Besançon. M. Viguier (Cahours prize), killed at Beauséjour, March 5, 1915, made his mark in the field of organic chemistry. M. Albert de Romeu (Delesse prize), killed January 12, 1915, at Bucy-le-Long, near the Aisne, was the author of noteworthy petrographic work. M. René Tronquoy (Joseph Labbé prize), wounded and missing, February 20, 1915, was proposed for the Cross of the Légion d'honneur, and was well known for his mineralogical work. M. Blondel (Saintour prize), wounded and missing, September 8, 1914, at Fère-Champenoise, was distinguished for his work on the theory of tides. M. Georges Lery (Gustave Roux prize), killed at the battle of the Marne, September 10, 1914, was a geometer of great promise. Lieutenant-Colonel Arnaud (Henri Becquerel prize), aged sixty years, died of illness contracted on active service. M. Jean Merlin (Becquerel prize), on the staff of Lyons Observatory, killed at Arrozel, August 29, 1914. He was known by his researches dealing with the theory of numbers. M. Rabioulle (Becquerel prize), on the staff of the Algiers Observatory, killed in the battle of the Aisne, September 21, 1914. M. Jean Chatinay (Fanny Emden prize), killed at Vermelles, October 15, 1914. Commandant Henri Batail-

ler (Wilde prize), killed June 9, 1915, well known for his researches in ballistics.

UNIVERSITY AND EDUCATIONAL NEWS

By the will of the late Dr. J. William White, trustee of the University of Pennsylvania, and John Rhea Barton emeritus professor of surgery, $150,000 is bequeathed in trust as a permanent endowment fund, the income to be used for establishing a professorship of surgical research in the medical department of the university. Other bequests were made to the university hospital.

A million dollars will be available for use by the Washington University Medical School, with the opening of the new term in September, through the donation to the school of $166,000 each by Edward Mallinckrodt and John T. Milliken, of St. Louis. One fund of $500,000, which will be known as the Edward Mallinckrodt Fund, will be devoted to teaching and research work in pediatrics. The other fund of $500,000, which will be known as the John T. Milliken Fund, will be devoted to teaching and research work in medicine. The funds will enable the medical school to employ physicians in these departments for their full time. The amount in addition to the Mallinckrodt and Milliken donations to bring it to $1,000,000 has been given by the General Education Board.

A movement has been inaugurated to secure at least $2,000,000 additional endowment for Jefferson Medical College, Philadelphia. Mr. David Baugh, a member of the board of trustees, and founder of the Baugh Institute of Anatomy and Biology, has subscribed $100,000, provided that an equal amount is raised on or before June 16. The money so obtained is to be used for permanent endowment.

The executors of the estate of Emil C. Bundy, of New York, have paid over to Columbia University the sum of $100,000, for research work in cancer.

Dr. Jean Piccard, of the University of Lausanne, Switzerland, has been appointed assistant professor of chemistry in the University of Chicago, beginning with the autumn quarter of this year. Professor Piccard is of the same nationality as the late Professor John Ulric Nef, who for more than twenty years was the distinguished head of the department of chemistry.

Dr. Henry W. Wandless, of New York, has been appointed clinical professor of ophthalmology at the University and Bellevue Hospital Medical College.

Wm. F. Allen, formerly instructor of histology and embryology in the University of Minnesota, has accepted the position of professor of anatomy in the University of Oregon Medical School, Portland, Oregon.

At Vassar College Dr. Elizabeth B. Cowley, assistant professor of mathematics, has been promoted to an associate professorship.

Sir James Alfred Ewing, K.C.B., F.R.S., has been elected principal of the University of Edinburgh, in succession to the late Sir William Turner. Sir Alfred Ewing, who is a graduate of the university, has been for the last thirteen years director of naval education; before that he had been in succession professor of mechanical engineering in the Imperial University, Tokyo; of engineering in University College, Dundee, and of applied mechanics in the University of Cambridge. His scientific work has been chiefly in the investigation of magnetism and the physics of metals.

DISCUSSION AND CORRESPONDENCE

PUBLIC HEALTH WORK AND MEDICAL PRACTISE

To the Editor of Science: To the statement that no sharp line can properly be drawn between preventive medicine as embraced in public health work and curative medicine as applied to individuals Mr. Harold F. Gray in Science for May 5 has applied the term "fallacious." While it may in general be true that "under our form of government, it is not possible for public health officers to apply by compulsion remedies to diseased citizens," it is also true that in a democracy a large share of public health work lies outside the field of arbitrary compulsion.

Quarantine of individuals afflicted with communicable disease represents one of the earliest and most arbitrary of public health measures. The stoning of a leper to keep him away from a community without regard to the welfare of the leper himself is not, however, to be regarded as a sign of a high stage of civilization. We reach a higher stage when special provision is made for the care of lepers isolated from the community for the good of the community. We reach a still higher stage when earnest efforts are made to discover remedies for the cure of the disease such as are now being made by the federal health service. If such remedies are discovered and applied, both lepers and the community at large will profit.

The legal aspects of the matter are well summarized in a decision of the Wisconsin Supreme Court as cited in "Communicable Diseases: An analysis of the laws and regulations for the control thereof in force in the United States," Public Health Bulletin No. 62, by J. W. Kerr and A. A. Moll.

> The right of a state through its proper officers to place in confinement and to subject to regular medical treatment, those who are suffering from some contagious or infectious disease, on account of the danger to which the public would be exposed if they were permitted to go at large is so free from doubt that it has rarely been questioned (State *v.* Berg Northwestern Reporter, p. 347).

The federal public health service has charge of the restrictions imposed upon individuals afflicted with disease who desire to enter the United States from outside and is required to cooperate with local health authorities in enforcing regulations to prevent the spread of contagious and infectious diseases from one state or territory to another.

> In connection with the medical inspections of immigrants, medical officers are required, among other things, to certify to the diseases observed by them and to render opinions, whenever requested, as to the curability of a loathsome contagious or dangerous contagious disease affecting the wife or minor child of a domiciled alien, and to supervise the appropriate treatment. In addition they are required to supervise or conduct the treatment of all detained aliens.

In the various states of the union the number of diseases for which quarantine is required by law and the extent of the quarantine differ greatly but it is fairly generally recognized that in cases where strict quarantine is required the public is under obligations to furnish treatment at least to individuals not able to pay for medical service. The quarantine is compulsory, the treatment is not necessarily so, but both may properly form a part of the public health service. At times special care has been taken to emphasize the fact that individuals thus receiving medical service at public expense are not thereby made paupers.

Private agencies may cooperate with public health officials in the warfare on disease through treatment of individuals. The various anti-tuberculosis associations are accomplishing much in their efforts not only to educate the public as to proper precautions to be taken to prevent the spread of this disease but also in their support of measures for the establishment of sanatoria for the treatment of incipient cases and homes for the isolation of advanced cases. The effective work of the Rockefeller Sanitary Commission in cooperation with various boards of health in the south for the eradication of hookworm disease is an example of where medical treatment of individuals in the ordinary use of that term has played an active part in public health work.

Various steps have been taken to give state aid to physicians in their treatment of individuals in order that the public health may be promoted. Examples are to be seen in the distribution of diphtheria antitoxin free either for all cases or more frequently for all indigent cases. Vaccines for smallpox and typhoid fever are distributed in a similar way for the prophylactic treatment of individuals, from which in turn the community profits. Public health laboratories established to give aid in diagnosis to physicians in private practise are becoming of increasing importance from the standpoint of public health. It is thus that the first steps are being taken in control of venereal diseases.

In public health work we have, on the one hand, engineering problems into which dis-

eased individuals as such do not enter. On the other hand we have the problem of the prevention of the spread of diseases from the sick to the well. In private practise we have, on the one hand, the treatment of sick individuals in whose welfare the public as such, aside from humane sympathy or the danger of attendant financial burdens, has no concern and, on the other hand, the treatment of individuals who so long as they are ill are of more or less danger to the community at large. The fields of the sanitarian in the prevention of the spread of disease from one individual to another and of the private practitioner in his care of individuals afflicted with communicable disease interweave. The duty of the public health officer is to see that such persons are cared for in a way that prevents so far as possible the spread of disease. The private practitioner attending such individuals is required to observe regulations in the interest of the public health. Questions of public interest should determine to what extent treatment of individuals by private practitioners should be supplemented by state officers. There certainly need be no fear that medical treatment furnished sane adult individuals for their own welfare by public officials will be forced on them at the expense of their individual liberty. In medical supervision in the public schools it has not yet been determined to what extent medical inspection of the school children should be supplemented by furnishing medical treatment at public expense, but such treatment is likely to increase in the future. In the assumption by the public of responsibility for the health of children as individuals, a responsibility that is beginning to extend back of the school years, public health duties are assumed which reach far beyond the control of contagious diseases and are of great importance to the welfare of the race. Perhaps some time we shall see in times of peace as effective a medical service as nations which desire success must have for their armies in times of war. Here we see no line drawn between services for preventive medicine and curative medicine. Fortunately our own army medical service has been able to furnish some of the most important recent advances in preventive medicine, of value alike in times of peace and times of war, an interesting summary of which has recently been given by Henry B. Hemenway.[1] It is noteworthy that the most important American contributions both to the science of public health and to the application of this science have been made by medical services which include within their scope research, prevention and treatment, the Army Medical Service and the Federal Public Health Service.

C. R. Bardeen

NOMENCLATORIAL CONSISTENCY?

Nothing more strikingly illustrates the hopelessness of unanimity among systematists on nomenclatorial matters than a footnote in a recent article by Mr. Hebard, *Ent. News*, Vol. XXVII., p. 17 (1916). Here he protests strenuously against the resurrection of the orthopterous genus *Pedeticum* of McNeill, which he maintains is preoccupied by the hemipterous genus *Pedeticus* of Laporte. But these two names do not conflict according to the apparent meaning of Article 36 of the International Rules of Zoological Nomenclature, where it is recommended that names even derived from the same radical and differing from each other only in termination are not to be considered as conflicting. Furthermore, opinion 25 of the International Commission bears directly on this subject, quotes from the above mentioned recommendations and decides that *Damesella* does not conflict with *Damesiella*. Dr. C. W. Stiles, the secretary of the International Committee on Zoological Nomenclature, and our foremost authority on nomenclature, when consulted regarding the matter of *Pedeticum* and *Pedeticus*, expressed the opinion that these two names should not be considered as conflicting. But Mr. Hebard contends that the ornithologists and mammalogists have long ago settled this matter, the one-letter rule being suppressed unless indicating different word derivation. This being true, how about those, including Mr. Hebard himself, who profess themselves followers of the International Rules? Is it to be assumed

[1] "American Health Protection," Bobbs-Merrill Company, 1916.

that they follow these rules as such rules are usually followed, that is only so far as they conflict with no personal opinion?

In the above-mentioned note Mr. Hebard expresses regret that well-known names should be changed on debatable grounds. In view of this statement it is interesting to note his use in the same paper, page 19, of the name *Schistocerca serials* Thunberg instead of *Schistocerca americana* Drury, a name in common use long before *Pedeticum* was erected. That the original inclusion of the species *americana* in the genus *Libellula,* which makes it a primary homonym of *Libellula americana* Linn., a true dragon fly, was a *lapsus* seems clear for several reasons, a matter too complicated for discussion at this time. However, even if granted as obviously a *lapsus calami,* there appears to be no definite authority in any code of rules for the setting aside of this reference. Thus Mr. Hebard's suppression of the name *americana* is accepted, but, until a decision is rendered on the case by the International Commission, the grounds upon which he suppresses it are certainly debatable, more so, in fact, than those upon which the present writer resurrects the genus *Pedeticum.* Indeed this action of Mr. Hebard would probably not be sustained by the International Commission if it acts on the case, as its decision would very likely agree with the private opinion of its secretary, Dr. C. W. Stiles, as stated in the authorized quotation here given from a letter written on April 10, 1916:

> . . . In the case of *Libellula americanus* Drury, 1770 (in index of later date) it seems clear that this is a *Lapsus calami.*
>
> Without attempting to commit the Commission to any view, I personally would not reject—especially at the present moment—a well-known name like *Gryllus americanus* seu *Schistocerca americana* because of an obvious *lapsus calami.*

Dr. L. Stejneger, also a member of the Commission on Zoological Nomenclature, authorizes the statement that his present views on this matter coincide with those expressed in the above quotation.

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THE CURRENT "DEFINITIONS" OF ENERGY

TO THE EDITOR OF SCIENCE: In a communication which appeared in a recent number of SCIENCE[1] Professor M. M. Garver criticizes the current definitions of energy, such as "the capacity for doing work," the "ability to do work," and the "power of doing work," on the ground that these definitions are not consistent with the concept of energy. The terms "capacity" and "ability" do not mean entities, while energy is not only a physical entity but it has the property of conservation.

It seems to me that Professor Garver's criticism is well taken, but the alternative he proposes is open to criticism also. For Professor Garver would have no definition of energy at all or, if it is insisted upon, he would have it based on the principle of the conservation of energy.

Energy is first introduced in text-books of physics as a mechanical concept. Therefore any definition of energy should form an integral part of a logically developed system of mechanics. It should be the direct and natural result of the dynamical concepts which precede it and should form an adequate basis for the new ideas which follow it. Further it should have such a form as to lend itself easily to a mathematical expression of the definition. Elementary mechanics is usually based upon postulates, such as Newton's laws of motion or the action principle, which involve the concept of force. Therefore the definitions of energy and momentum as well as the principles of the conservation of energy and of momentum should be made the direct consequence of the postulates which have been selected as the starting point of the development of mechanics. This necessitates the definition of energy as the "result of the action of force in space" and the definition of momentum as the "result of the action of force in time." In other words, energy should be defined in terms of work and momentum in terms of impulse. The definition of energy contained in the following extract fulfills these conditions. It is not only consistent, but has the advantage of leading to the mathematical expressions for kinetic and potential energy.

[1] SCIENCE, April 21, 1916.

Energy may be defined as work which is stored up. Work stored up in overcoming kinetic reactions is called kinetic energy. Work stored up in overcoming non-frictional forces, such as gravitational forces, is called potential energy. Work done in overcoming frictional forces is called heat energy.

Potential, kinetic and heat energy are different (at least apparently[2]) forms of the same physical entity, *i. e.*, energy. Energy may be changed from any one of these forms into any other form. Whenever such a change takes place energy is said to be transformed. Transformation of energy is always accompanied by work. In fact the process of doing work is that of transformation of energy. The amount of energy transformed equals the amount of work done.[3]

Yale University

UNITS OF FORCE

To the Editor of Science: I have read with much interest Professor Kent's article in Science on the units of force. I might say that I have taught mechanics in my physics course this year, using the units the way Professor Kent recommends. The results have been entirely successful and highly gratifying. I used the pound and the gram as the units of mass and the pound and the gram as the units of force. As far as the results to the student go it has resulted in conciseness and clearness of thought and an avoidance of the unescapable confusion that results from introducing units that nobody but a teacher of physics wishes to use. Not only did this apply to force equations but it had a good result all along the line in problems on work energy and power. I embodied in my method of teaching the things that Professor Kent recommends and also many of the things that Professor Huntington recommends. I believe that a great deal of the trouble is due to the fact that most of our teachers of physics do not have the point of view of the engineer (they should have if they teach engineers) and I believe that the only way to get this point of view is in the school of practical engineering. This hodgepodge of units which some of us wish to use are undesirable and pedagogically unsound.

Paul Cloke

[2] Recent developments in physical sciences tend to show that differences between different forms of energy are only apparent and that all forms of energy are, in the last analysis, kinetic.

[3] H. M. Dadourian, "Analytical Mechanics," 2d edition, p. 248. H. M. Dadourian

THERMOMETER SCALES

To the Editor of Science: In a letter published in Science of May 5, 1916, page 642, a correspondent advocating the retention of the Fahrenheit scale says that "nine tenths, probably, of the use of the thermometer is for the weather" a statement that should not pass unchallenged; but even if there were no other uses of the thermometer, the Fahrenheit scale would still be objectionable. If your correspondent will visit any extensive meteorological library, he will find that nearly all national weather services now use the Centigrade scale and that internationally no other scale has been recognized for some years. Even the few weather services retaining the Fahrenheit scale, restrict its use and banish it from all investigational and research work.

It is urged that "the common people are familiar with the Fahrenheit scale." They may be familiar with it and yet not understand it. When the temperature is 64° F., is it clearly understood by every one, that the temperature is 32 degrees above freezing; and on the other hand when it is —32° F., that the temperature is 64 degrees below freezing? The scale says one thing and means another. It is true that the Centigrade scale division is nearly twice the length of the other scale division; and much has been made of this by some who insist upon accuracy to the tenth of a degree; but it may be well to remember that most air temperatures are a degree or more in error. Even with official instruments, errors of exposure or time, exceeding several degrees, go uncorrected, while instrumental errors are applied to a tenth of a degree. On the daily weather map one finds isotherms charted from readings made at different hours and different elevations. A reading made at 5 A.M. in the Nevada desert is linked up with readings made at 8 A.M. on the Atlantic seaboard. Some years ago, I suggested to the

former chief of the Weather Bureau that the hour of observation be given at the top of the map; and the suggestion was adopted; but the type used is small and at best this is only a makeshift. If the isotherms are to have true comparative value, diurnal corrections should be applied, whatever scale be used to express values.

At Blue Hill Observatory, no less than three scales have been used and we are now considering a fourth. Beginning with 1891, the Centigrade scale displaced Fahrenheit in our published summaries. In 1914 the Absolute scale displaced the Centigrade, the first of the three figures being written once in tabular work at the head of the column. The use of minus signs for low temperatures, frequent in winter months for surface readings, and in all months with upper air readings, is thus avoided.

The objection made, however, to the length of the Centigrade division holds also for the Absolute scale and therefore the writer suggested[1] a scale based on the Absolute system but with the present 273° marked 1,000°.

For many reasons the freezing point is important. The new scale emphasizes this point. The boiling point is not so definitely marked but the whole system has the advantage of flexibility and consistency. For thermodynamic problems it is an ideal arrangement.

ALEXANDER MCADIE

SCIENTIFIC BOOKS

American Civilization and the Negro. By C. V. ROMAN, A.M., M.D., LL.D., Editor of the Journal of the National Medical Association, etc. Philadelphia, F. A. Davis Co., 1916.

This book is obviously prepared and published as an antidote for Shufeldt's book on the negro, issued last year by the same firm.[1] As such, it is a complete and amusing success. The word "amusing" is used advisedly, for Dr. Roman has by imitation without comment emphasized many of the weaknesses and defects of Dr. Shufeldt's book. Moreover like most of his race, Dr. Roman has a keen sense of humor and real skill in the use of witty phrases, so that many of his aphorisms are exceedingly clever. From the title-page, with its long list of degrees, honors and positions, following the author's name, to the very full glossary at the end of the book, Roman has taken his cue from Shufeldt, with such good-natured appreciation of the Caucasian author's failings that any one who has read both books can not help but be amused. In no respect is this done better than in the matter of illustrations. In neither volume is there any particular connection between text and plates, but whereas Shufeldt's figures are deliberately chosen to exaggerate the animal nature of the negro and make him repulsive to the reader, Roman's illustrations are selected to exaggerate his intellectual and spiritual achievements and make him most attractive.

Neither volume is in any real sense a scientific book, but whereas Shufeldt's pretends to be, Roman's makes no such claim. The latter author says truly in his Preface: "This book is written without bitterness and without bias" and in the hope that it "may increase racial self-respect and diminish racial antagonism." The good nature and self-control of the author are notable and his evident familiarity with the literature of the subject is equally so. There are very few references to Shufeldt, Bean or other negrophobists, but many quotations from Boaz, Murphy and Cable, real and sympathetic students of the race problem. The chief contention of the author is that there is no superior *race,* but that there are superior *individuals,* and that the effort of all races should be to increase the number of these superior individuals of whatever race, while weeding out the inferior. He admits frankly that at the present time, the whites average higher than the negroes but he very properly claims that there is far less difference between the best whites and the best negroes than there is between the better and worse elements of either race. His chief protest is against the utterly unfair and unscientific method of treating all colored people alike because they are colored, and he emphasizes the

[1] *Physical Review,* N. S., Vol. VI., No. 6, Dec., 1915.

[1] See SCIENCE, N. S., Vol. 42, p. 768.

importance of encouraging the development of the exceptional individual in every race.

The fifteen chapters which make up the volume are of rather unequal merit and seem to have no natural sequence. This defect of arrangement is emphasized by faults of style. The writer is discursive and tends to glowing rhetoric, "glittering generalities" and overmuch interpolation of poetry and emotional anecdote. There is too much repetition and iteration, oftentimes on trivial points. In spite of all this, the book is readable and enjoyable because of the author's skill in putting telling points in brief, pithy sentences. In discussing physiognomy as a criterion for judging men, he says: "As a man *thinks*, not as he *looks*, finally fixes his status," and again, referring to facial angles and jaw form, "Thoughts and not bites win the battles of life." In reference to the origin of the southern negroes, we find these apt words: "The question then is, not where did he start from, nor how long has he been on the road, but *has he arrived?*" In chapter ten, "The Solution," probably the best chapter in the book, there is an admirable plea for the suppression of those people who, and things which, tend to encourage racial friction. The following deserves quotation. "Dixon and Johnson have been drawbacks to their race and country. It was an unfortunate thing for the country that popular notice was given to the Leopard Spots or the Reno Battle. If neither had been noticed the subsequent 'bad eminence' of the chief actors would not have marred the country's history."

The frankness and fairmindedness of Dr. Roman are constantly in evidence. His appreciation of the point of view of the best southern whites is delightful and most encouraging. Referring to their claim of "the absolute and unchangeable superiority of the white race" he says: "Fundamentally erroneous and mischievous as I believe this assumption to be, I am not disposed to quarrel over it with such men as Messrs. Page and Murphy." "From different starting points, Mr. Page and I reach the same conclusion: 'Our plain duty is to do the best we can to act with justice and a broad charity and leave the consequences to God.'" One other quotation is necessary to reveal the point of view of the best southern colored men on that bugbear "social equality." Dr. Roman says: "I know my people, their hopes, their fears, their aspirations and their desires; and from my youth up I have preferred a discreet silence to false or dishonorable speech. With all candor and earnestness I say to the American public: *the negro has no desire to break over social barriers. In this regard he is if possible more strongly prepossessed in favor of his own than the white man.* In these matters the negro is not only pleased but happy to work out *his own equivalent rights.* But in civil, political and economical matters the negro insists and for the good of the country ought to insist upon *equal*, not *equivalent*, rights." If this is not a scientifically impregnable position, your reviewer fails to detect its weakness. It seems to him obvious that the one possible solution of the race question lies in strengthening racial self-respect and mutual interracial confidence. For this reason, all legislation looking towards segregation of either race is sadly mistaken and postpones indefinitely the solution intelligent men on both sides are seeking. As Dr. Roman truly says: "White ignorance is the most serious menace in the race situation; for this ignorance is in power and hopes to benefit itself not by finding more light but by increasing darkness." Colored ignorance is much less mischievous because so much less powerful, but it is of course a serious menace. Racial self-respect should be greatly promoted among the negroes by the publication of Dr. Roman's book, and racial comity should be likewise advanced. For there is as much for the white race in the volume as there is for the author's own people.

Hubert Lyman Clark

The Elements of Surveying and Geodesy. By W. C. Popplewell. Longmans, Green and Co., London, 1915. Pp. ix + 244, illustrated.

The author states in the preface of this volume that he has made an attempt to present a comprehensive view of the subject of geodesy in its widest sense in order to provide students and others with such information as may lead

to a sound knowledge of the fundamental ideas involved. As leading towards this the author said he has always advocated personal instruction in the use and adjustment of instruments, as well as the useful practise which may be obtained in a students' surveying camp, but that before either of these is possible the student must have mastered the bedrock principles, and the author hopes that a careful perusal of the pages of the volume may help him to do this.

The book is disappointing and is not recommended to the student of engineering nor to the practising engineer as a guide or manual. It seems to be more suited to the old-fashioned county surveyor, with his Jacob's staff and Gunter's chain, for the county surveyor of today, in the United States at least, is more inclined to use the steel tape and the transit than those old instruments, which should be relegated to the museum.

The chapter on "Calculations of Distances and Heights" opens with the statement that "It is assumed that the reader has some knowledge of plane trigonometry." In this country there is probably no school teaching surveying which does not require a rather thorough course in plane trigonometry as a preliminary to the course in surveying.

Under the heading, "Levelling and Contouring" this significant statement is made: "The staff-holder should be very careful to see that the particular spot of ground upon which the staff rests is fairly flat, and if the ground is of a soft or spongy nature the spot should be pressed down with the foot." This is not teaching correct principles, for there is scarcely any leveling which should not require solid supports for the rod, and the earth, even if "*pressed down by the foot*," can not be considered a satisfactory rod support.

The short chapter on "Geodetic or Trigonometrical Surveying" is almost entirely historical and gives the student nothing which would guide him in actual work. Even the historical part does not include the recent developments and methods.

The chapter on "Geodetic Astronomy" is particularly disappointing, for it deals with only those methods which might be used in explorations and in determining the variation of the compass.

It is very difficult to see where or how such a book has any useful purpose, for there are so many other books available which are far better for both the student and the engineer.

WILLIAM BOWIE

Diabetes Mellitus. By NELLIS B. FOSTER, M.D. J. B. Lippincott and Company, 1915.

This is a model monograph for the modern practising physician. Clearly written and not too technical in language, it is still thoroughly scientific in the mode of presentation. The rapid advance in the knowledge of the fundamental biochemical processes which take place within the living body has nowhere been more pronounced than in studies concerning the nature of diabetes, a disease in which the oxidation of glucose, a substance which ordinarily furnishes two thirds of all the chemical transformations of the organism, has been impaired or totally abolished. Dr. Foster has presented all the essential details concerning the pathological chemistry of diabetes, and has at the same time written from that three-fold standpoint which controls the value of a modern medical book, personal research, personal clinical experience, knowledge of the research and clinical experience of the best authorities of the modern world. In no other book on diabetes has the value of American work been so fully recognized, and the reviewer feels that it is the best book upon the subject which has been written.

GRAHAM LUSK

SPECIAL ARTICLES

PERMEABILITY AND VISCOSITY

IN a recent article[1] Spaeth has suggested that the permeability of the surface layer of protoplasm is determined by its viscosity, which in turn depends on its colloidal condition. Increased permeability may be produced by increased colloidal dispersion, which decreases viscosity and permits substances to diffuse more rapidly into the protoplasm. An

[1] SCIENCE, N. S., 43: 502, 1916.

increase of colloidal aggregation increases viscosity and causes a decrease of permeability: but if this goes beyond a certain point it produces "a decrease in the degree of intimacy between disperse phases and solvent; the fluidity is suddenly increased and diffusion across the surface is correspondingly facilitated."

Some years ago a similar conception was suggested to the writer by the fact that living tissue of *Laminaria* placed in NaCl[2] becomes much softer while in $CaCl_2$ it becomes much harder. The changes in viscosity are so great as to suggest that they are fully capable of explaining the fall of the electrical resistance of the tissue which occurs when it is placed in NaCl and also the rise of resistance which occurs in $CaCl_2$ (which is always followed by a fall of resistance).

In the hope of throwing some light upon this process sections of the tissue were observed in $CaCl_2$ under the microscope. It was then seen that after a time the protoplasm assumed a coagulated appearance: it seemed obvious that the process which increased the viscosity might produce a coagulation of the protoplasm or some other change in its structure whereby it became more permeable.

This conception led the writer to expect decreased resistance in tissues placed in NaCl (because of decreased viscosity) while in $CaCl_2$ we should expect to find increased resistance (due to increased viscosity) followed by a fall of resistance (due to coagulation or other structural change in the protoplasm).

It soon became apparent that there were several serious objections to this conception. The most important of these may be briefly stated as follows:

1. If to a solution of NaCl we add $CaCl_2$ until the increase of viscosity produced by one salt is just balanced by the decrease produced by the other, the resistance should remain stationary. This is not the case, though it seems to be so when the observations are not taken frequently enough (as happened in some early experiments). There is always a fall, or a rise followed by a fall, of resistance.

2. If more $CaCl_2$ be added there should be a rise of resistance: this should after a while become stationary, provided there is not enough $CaCl_2$ to produce the coagulation or other structural change which decreases the resistance. This does not occur: the tissue never maintains its increased resistance, but shows a fall of resistance which begins soon after the maximum is reached.

3. If still more $CaCl_2$ be added, so as to produce the coagulation or other structural change which decreases resistance, we should expect to find in all cases the same viscosity (and consequently the same maximum of resistance) just before the fall begins. Still further increase of $CaCl_2$ would only hasten this process without changing the maximum. This does not correspond with the facts. The maximum steadily rises as the proportion of $CaCl_2$ increases, so that the greatest maximum is found in pure $CaCl_2$.

4. If the fall of resistance in $CaCl_2$ is due to coagulation or to some other structural change it might be expected to be irreversible almost from the start; but this is not the case. Only when it has proceeded a good way toward the death point does it become irreversible. On the other hand the fall in NaCl (due to liquefaction) might be expected to be reversible at every stage. But it ceases to be wholly reversible after it has proceeded one sixth of the way (or less) to the death point.

5. The effect of anions on the permeability of *Laminaria* is completely at variance with their effect on the viscosity of colloids as seen in Hofmeister's series.

6. Since the changes in viscosity occur in dead as well as in living tissue we should expect to find in both cases similar changes in resistance. It is found that the decrease in viscosity in NaCl produces no appreciable effect on resistance. Even when the process proceeds so far that the tissue is reduced to a very soft jelly there is little or no change in resistance.[3] The hardening in $CaCl_2$ produces some rise in resistance, but it is much too

[2] Throughout this paper NaCl and $CaCl_2$ of the same conductivity as sea water are referred to.

[3] In a liquid a change of viscosity alters the resistance, but this is not necessarily the case in a gel.

small to account for the great changes which occur in living tissue.

It might be supposed that the reason that no change in resistance occurs in dead tissue is because the hardening and softening do not proceed as far as in living plants, but this is not the case. Moreover, it is found that the increase of viscosity in NaCl is accompanied by absorption of water, while the decrease of viscosity in $CaCl_2$ is accompanied by loss of water, and these processes take place in the same way in living and dead tissue.

It would seem that these and other important objections must be removed before we can accept the idea that changes in permeability are determined by changes in viscosity.[4]

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POLLEN STERILITY IN RELATION TO CROSSING

IN view of the recent revival of the old idea that pollen sterility is a universal and safe criterion of hybridity in plants[1] we found it of interest recently to examine the pollen of some California plants with this idea in mind.

The first species examined, *Trillium sessile* var. *giganteum*, perhaps better regarded as *T. giganteum*, a separate species from the *T. sessile* of the eastern states, is found in quantity in Strawberry Canyon, Berkeley, where it is now in full bloom. It is already known that this species shows a remarkable degree of variability, especially in the color and width of the petals. In color the petals vary from dark purple through pinks to nearly white, and also through yellows to nearly pure green. One of us is making a detailed study of these variations. The former color series, combined with the width series, is found on one hillside in Strawberry Canyon, the greenish and yellowish series occurring across the bay in Marin County. No other Trillium occurs in this canyon, but a variety of *T. ovatum* occurs along with *T. giganteum* in various parts of Marin County. The two forms are not closely related, however, and it is extremely doubtful if they ever cross. In Strawberry Canyon at any rate there is no possibility of *T. giganteum* crossing with any other species, yet some plants collected here show a considerable amount of sterile pollen.

In all the pollen examinations the grains were only considered "bad" when they were obviously shrivelled or greatly undersized, so that the amount of non-viable pollen would doubtless be considerably larger than the percentage recorded here as bad. The highest amount of bad pollen recorded from any normal plant of *T. giganteum* from Strawberry Canyon was 18.2 per cent., and the lowest 3.2 per cent. In another plant having certain abnormalities of the flower the percentage was as low as 1.5 per cent. In five plants from Camp Taylor, Marin County, where the species grows in company with *T. ovatum*, the percentages of bad pollen were respectively 7.3, 5.6, 3.9, 3.2, 2.3. Thus the amount of defective pollen is not high in any of the plants examined, with one exception, though the pollen grains are never all perfect.

The form of *T. ovatum* occurring in Marin County is remarkably uniform, in contrast with the variable *T. giganteum*. The pollen from seven plants of *T. ovatum* was examined, and they were found to have respectively 7.3, 7, 5.3, 4.5, 4.2, 3.9 and 3.9 per cent. bad pollen grains. Thus a species which is very invariable in this locality and which we can be quite certain does not cross with *T. giganteum*, nevertheless produces regularly a certain percentage of shrivelled and misshapen grains.

Still more conclusive evidence regarding the occurrence of considerable quantities of bad pollen in the absence of crossing was furnished by *Scoliopus*. This remarkably isolated genus of the Liliaceæ contains only two species, *S. Bigelovii*, which is confined to California from Santa Cruz to Humboldt County, and *S. Hallii*, which occurs in western Oregon. In plants of *S. Bigelovii* collected in Marin

[4] It would appear that the term viscosity is loosely applied to a variety of phenomena which may be produced in different ways.

[1] Jeffrey, E. C., 1915, "Some Fundamental Morphological Objections to the Mutation Theory of DeVries," *Amer. Nat.*, 49: 5–21, Figs. 7.

County, where all possibility of crossing is excluded, there was found a most unexpected amount of shrivelled pollen grains. One flower was examined from each plant. The flowers have three anthers and in some cases anthers from the same flower yielded different percentages of bad grains. Yet the anthers, and the plants as a whole, were all entirely normal in appearance. The amounts of bad pollen are shown in the following table:

Pollen of Scoliopus Bigelovii

Plant	Bad Grains Per Cent.	Individual Anthers Per Cent.
No. 1.....	31.9	45.4
		25.8
		33.2
No. 2.....	20.6	—
No. 3.....	18.5	6.4
		25.6
		6.5
No. 4.....	10	10.7
		9.04
No. 5.....	9.9	11.1
		7.8
		10.4
No. 6.....	3.75	—
No. 7.....	3.25	—

Thus, in the absence of crossing, these plants in their normal habitat produce from 3 per cent. to 32 per cent. of bad pollen, and in individual anthers the observed amount exceeded 45 per cent. This in itself is a sufficient refutation of the hypothesis that bad pollen is necessarily a sign of hybridity. It would be difficult to find a plant which is more suitable for disproving this hypothesis than *Scoliopus Bigelovii*. It furnishes all the conditions that the most captious critic could desire, including relative uniformity and the absence of a related species with which it might cross. Yet, with two exceptions, it shows a higher percentage of bad grains than any other plant examined.

Dirca occidentalis furnishes an even more convincing proof that bad pollen may occur in quantity in plants that are not hybrids. This shrub belongs to an isolated genus of the Thymeleaceæ, the only other species being found in the eastern states. Pollen examined from three separate flowers on the same branch yielded respectively 8.7 per cent., 20.8 per cent. and 46.6 per cent. of bad grains. Many of the pollen grains are also conspicuously undersized, so that the amount of nonviable pollen in this plant apparently often far exceeds 50 per cent.

The pollen of two other species taken at random has also been examined, with the following results.

Ranunculus Californicus showed in one case 21.7 per cent. bad pollen and in another case 4.4 per cent. The pollen of *Fritillaria lanceolata* var. *floribunda* appears to contain regularly more than 50 per cent. of bad grains. These are both variable species, and in this case the possibility of crossing is not excluded. They are included here so as to avoid the publication of selected results.

It is certain, then, that bad pollen, even when it occurs in large amount, is not necessarily an indication of hybridization. Pollen sterility is rather a physiological condition which occurs in all degrees of intensity and may be due to a variety of causes. Hybridization is of course one of these, but only one.

Multiple causes apply in the same way to the conditions of sterility in animals. The mule is sterile because it is a hybrid whose parents are not only very dissimilar but have different chromosome numbers.[2] On the other hand, the various species of the genus *Bos* apparently intercross freely without any sign of sterility.[3] To cite one other case of sterility of an entirely different character, Morgan[4] showed that in certain generations of Phylloxerans in spermatogenesis, half the sperma-

[2] Wodsedalek, J. E., 1916, "Causes of Sterility in the Mule," *Biol. Bull.*, 30: 1–57, Pls. 9.

[3] Similarly, Dorsey ("Pollen Development in the Grape with Special Reference to Sterility," Univ. of Minnesota Agric. Expt. Sta., Bull. 144, 1914) concludes that in grapes hybridity is not necessarily a cause of sterility, since both sterile and fertile hybrids occur among cultivated varieties.

[4] Morgan, T. H., 1909, "A Biological and Cytological Study of Sex Determination in Phylloxerans and Aphids," *Jour. Expt. Zool.*, 7: 239–352, Pl. 1, Figs. 23.

tids (those lacking the accessory chromosome) regularly degenerate. This obviously has no connection with crossing, but is concerned with sex.

If we were to classify the causes of pollen sterility we might at least mention the following: (1) Crossing of sufficiently distinct species, (2) a condition of variability or mutability in the species, (3) the substitution of vegetative for sexual reproduction, (4) unknown physiological causes.

So far from it being improbable that mutability in a species should be accompanied by a certain amount of pollen sterility, we should be at a loss to account for the reverse condition, namely, a highly mutable species which had perfectly good pollen. For it is clear that in a mutating species various types of aberrant pollen grains must be produced, some of which may be unable to mature, and these will form shrivelled grains. This view is borne out by direct observations of pollen development in the Œnotheras. Moreover, some such gametes will form zygotes which are unable to develop, as has again been shown by direct observation in Œnothera. It follows almost from necessity that if the gametes of a mutable species are varying in many ways some of them will vary so as to produce pollen grains which are non-viable.

The view that a great increase in the vegetative methods of reproduction in a species may lead to or be accompanied by partial sterility of the pollen, is often expressed and apparently with reason. How narrowly such a relationship holds, however, could only be determined by statistical comparison. In the case of *Trillium, T. giganteum* apparently reproduces largely from rootstocks and *T. ovatum* chiefly from seeds.

From these preliminary observations it is clear at any rate that geographically isolated species do not invariably have good pollen, and that pollen sterility is by no means a sure sign of hybridity.

R. R. GATES,
T. H. GOODSPEED

UNIVERSITY OF CALIFORNIA,
March 16, 1916

ANTHROPOLOGY AT THE WASHINGTON MEETING

III

Indian Ruins of the Republic of Guatemala: FERNANDO CRUZ.

The ruins scattered throughout the territory of Guatemala are of two characteristic types: (1) Those properly classed as prehistoric, consisting of cities which were inhabited by races who occupied the territory centuries before the Spanish conquest and left notable vestiges of their civilization. (2) Those of a later period which were the fortifications used by the natives in their resistance to the Spaniards.

Those of the first class have been studied with care, at least the greater part of them; those of the second class have been viewed up to the present time with but little interest by archeologists. The ruins of this second class are simpler and do not reveal in their construction the same high grade of architectural beauty as those of the first class.

The author mentions the principal Indian ruins of Guatemala which have been studied, as well as those that have not yet been studied. He also gives a general idea of the arrangement of the cities, some of which he briefly describes.

With regard to the ruins of the cities contemporary with the Spanish conquest, the author notes that they reveal certain artistic decadence, and that in none of them is there to be found anything like the monoliths and sculptures of the former inhabitants. These ruins are of cities of a military character, fortifications intended for the resistance of the enemies in their domestic wars. The author indicates some of these ruins, and describes the condition in which they are to be found.

Native Languages of Guatemala: ADRIAN RECINOS.

After a few preliminary considerations with regard to the problems which demand the attention of the scientific men occupied in the study of the pre-Columbian epoch, the author proceeds to a study of the native languages of the races that have inhabited the Central American territory. He gives an outline of the Maya race and the grade of civilization which it attained.

The author does not believe that the native Central American languages can be described as dialects of the Maya. In his opinion they are perfect languages, with a construction, and some of them with a literature of their own.

Studying the different native races which inhabit Guatemala at the present time, and analyzing

their relations, the author concludes that they may be classified in the following groups: (1) The primitive language; the Sinca. (2) Maya-quiches, Mopán, Chol, Chortí, Quechí, PoconchíQuiché, Cachiquel, Zutijil, Pocomam, Mam, Aguacateca, Ixil, Uspanteca, Chuj y Jacalteca. (3) Languages of Nahuatl origin, Pipil, Alaguilac. (4) Caribes.

The author studies with care each one of these ethnic groups and the languages which they speak.

The report contains a bibliography and is accompanied by photographs of some of the types of Indians of Guatemala.

Sources of Cuban Ecclesiastical History: Rt. Rev. Charles Warren Currier.

History of the Cuban Church divided into five periods. Sources for each of these are given by the author, who laments the irreparable loss of manuscripts relating to the earliest history of the church in the West Indies. Among the more noted sources should be mentioned the Archivo Nacional of Havana, especially the large collections of manuscripts in Escota's library.

The Social Revolution of the Eighteenth Century in South America: Bernard Moses.

The society of Spanish South America at the beginning of the nineteenth century had departed widely from that which its founders proposed to establish. A point was reached somewhere in the colonial history where the ideals of the mother country ceased to dominate completely the life of the colonies. The greater part of Spain's constructive work in colonizing was done in the middle period of her colonial history.

Spain aimed to reproduce the European form of society in America: class distinctions, a titled nobility, feudalism, and a state church with great authority. When the colonies had become conscious of their individuality as communities, the influence of their environment led them to revolt against a social organization suited only to other circumstances. This revolt was strengthened by Spain's excluding creoles and mestizos from high office, in spite of their fitness. Growth of mestizo class was encouraged by preventing unmarried Spanish women from emigrating. In spite of local differences among populations of different districts, the creoles, mestizos, and the more cultivated free Indians were thrown into one class by the action of the Spanish government. This union was favored by the fact that Spain had adopted the Indians as an element of colonial society. Primary elements of that society were the *encomenderos* and their Indian dependents. A middle class grew later, composed of landless creoles, mestizos and free Indians. The upper class embraced Spanish officials, the nobility, and the clergy. The creole-mestizo class grew by natural increase faster than the Spanish class by immigration. The line of separation became fixed, with the more rapid growth on the part of the creole-mestizo class. The physical growth was not more rapid than the growth of new ideals and new aspirations; whence the holders of ancient Spanish ideals became a declining minority.

Spain's persistence in governing according to her established rigid, exclusive policy drove the two sections of the population farther and farther apart. When the creole-mestizo class became conscious that its interests were opposed to the purposes of the Spanish government, the social revolution was complete on its spiritual side. The later discussions, agitation, rebellions and military campaigns were only required to convince Spain and the world of the reality of the change.

A Forgotten Cereal of Ancient America: W. E. Safford.

Among the tributes paid to Montezuma by the various pueblos of Mexico were maize, beans, cacao, capsicum peppers, maguey syrup and bees' honey, salt, salvia seeds called *chian*, and *huautli* or *guautli*. Concerning the last-named, Albert Gallatin wrote as follows: "I can not discover what is meant by *guautli*. It is interpreted as being *semilla de bledo;* but I am not aware of any other native grain than maize having been, before the introduction of European cereals, an article of food of such general use, as the quantity mentioned (an annual tribute of 18 granaries full, each granary containing about 9,000 bushels) seems to indicate."

This seed was described in 1629 by Hernando Ruiz de Alarcon as "smaller than mustard seed" and ripening when the temprano maize begins to tassel. The Mexicans made of it certain dumplings (*bollos*), "which in their language they called *tzoalli*, and these they eat cooked like their tortillas." It was of these seeds, ground and made into paste, or dough, and mixed with agave syrup, that they made certain idols in human shape which they placed upon altars and to which they made offerings of pulque, incense and lighted candles or splints of pitch-pine (*ocotillos*). The following day the idols were divided into small pieces and administered to the worshippers like communion. Padre Acosta (1590) speaks at

length of the use of this seed in the worship of the god Uitzilipuztli. In his honor an idol was made by young virgins, who "*molian quantidad de semilla de bledos juntamente com mays tostado, y despues de molido amassabanlo con miel.*" It was undoubtedly this grain which Alvar Nuñez Cabeza de Vaca found on the west coast, where it took the place of maize as a food-staple. He refers to the plant as *bledos*, and states that the natives ate nothing else than flour made of it. The identity of the plant called *huautli, uauhtli*, or *guautli*, has long been a mystery. In the economic collections of the United States Department of Agriculture are certain seeds collected by the late Dr. Edward Palmer at Imala, Sinaloa, bearing the vernacular name "*guaute,*" which are used for food when maize is scarce. They are ground into paste, mixed with brown sugar, and made into balls called *suales*, which are wrapped in corn-husks and sold in the markets of Jalisco in strings called *rosarios de suale*. The seeds have been identified as those of *Amaranthus cruentus* L., a species closely allied to *A. caudata* L. At Colima Dr. Palmer saw a handsome variety with red spikes occurring both in cultivation and spontaneously, and in the vicinity of Guadalajara, both red and yellow varieties cultivated either alone or among maize. This species has a white-seeded form which was described by Sereno Watson as *A. leucocarpus*. It is interesting to note that very closely allied, if not identical, species, also having white-seeded forms, are cultivated as cereals in Tibet, the mountains of India, and in Peru and Bolivia.

Food Plants and Textiles of Ancient America: W. E. SAFFORD.

This paper is based on collections and observations by the author in Chile, Peru, Bolivia and Mexico, supplemented by the study of additional material from those countries and from various parts of the United States derived from ancient graves, cliff-dwellings, caves and prehistoric burial grounds. From prehistoric mounds and ancient village sites in the United States the only vegetable products preserved are those which have been charred by fire. From dry caves and cliff-dwellings of southwestern United States, food-products have been found in good condition, while from ancient graves of the arid coast region of Peru and northern Chile the organic material is in a remarkably perfect state of preservation. Not only such staples as maize, gourds, beans and peanuts, but leaves of *Erythroxylon coca*, soft pulpy fruits, including the lucuma, the chirimoya and various starchy tubers have been collected.

In addition to the fruits, seeds, grains, tubers, roots and leaves, many of which have already been recorded by Wittmack and others, beautiful representations in terra-cotta of these and other vegetable products have also been unearthed, principally in the vicinity of Trujillo and Chimbote, Peru. Casts of maize, squashes, peanuts, etc., occur on burial vases. Often the original model has been reproduced so accurately that the varieties are clearly discernible.

The paper deals with actual specimens concerning which there can be no doubt, dug up from prehistoric graves and discovered on the sites of ancient habitations. Among the most interesting objects to be shown are specimens of the "almond of Chachapoyas" (*Caryocar amygdaliforme*); the balsam of Peru, found in a calabash in a grave at Ancon; a ceremonial planting-stick with an ear of maize attached, represented in terra-cotta; a remarkable carving in stone from the vicinity of Oaxaca, Mexico, representing ears of maize; and specimens of maize from prehistoric graves of Chile, Argentina and Peru; from various parts of the southern United States, including mounds of the Mississippi valley, and from ancient village sites farther north. In connection with textiles, cotton cultivated by the ancient Peruvians and by the Indians of our own southwest will be shown; and, among other fibers those of various eurcæas, agaves and yuccas, of tropical America and southwestern United States.

The Puma Motive in Ancient Peruvian Art: CHARLES W. MEAD.

In the present state of our knowledge it is impossible to treat of the decorative art of the prehistoric Peruvians otherwise than as a whole, and no attempt has been made at a chronological sequence. The decorative motives most commonly employed are from the human figure, birds, fish and the puma, and these, together with such designs as undoubtedly owe their origin to the textile art, form a large part of the decorations found in Peruvian cloth and on the pottery vessels. The object of this paper is to show to what an extent the puma figures in Peruvian art, and to attempt the identification of some of the highly conventionalized designs.

The Rise of the Inca Empire: PHILIP A. MEANS.

Explanatory introduction summarizing reasons

for accepting Garcilasso's rather than Sarmiento's version of the rise of the empire.

A short survey of conditions in the Andean area prior to the rise of the Incas.

The reigns of the earlier Incas, those before Inca Rocca, briefly considered, the accessions of territory gained by each one (except the first two) shown by maps. The reigns of the Incas from Rocca to Huira-ccocha, inclusive, considered with special reference to the Chanca rebellion. A rather full enumeration of the conquests made by Pachacutec, together with a few remarks on the buildings erected by him and on the reforms in administration he introduced. An account of the reign of Tupac Yupanqui, with a presentation of the evidence pointing to his having reached some islands in the ocean out of sight of land. Concluding remarks, the empire at its zenith, the cataclysm.

A complete bibliography of works referred to in the paper.

Notes of Venezuelan Archeology: Luis I. Oramas.

The present paper contains the description of archeological exploration made by the author in the western and southwestern part of Venezuela. The region explored comprises the states of Aragua, Carabobo, Cojedes, Portuguesa, Zamora and Apure.

The first part of the paper refers to the exploration of the islands and shores of the lake of Valencia and other adjacent places. The tumuli and mounds of earth made by human hands, and the implements and human remains found, are described. According to the author not all of the mounds contained bones and implements; in some of them only bones alone are found. The author refers expressly to the vessels which he discovered in the interior of the lake, vessels which the Indians filled with human ashes.

The second part of the paper is confined to the causeways and mounds of the plains of the states of Portuguesa and Zamora. The causeways or elevations of consolidated earth, of variable height and slope, are constructed in the lowlands, which are flooded in the rainy season. The causeways frequently communicate with mounds similar to those in the United States which are referred to as having been made by the mound builders. The author describes these mounds and the objects which he discovered in them after making his excavations. The author thinks that these monuments were not constructed solely as tombs, but also as sacred places, and chiefly as military observatories. The author describes in detail and separately the different causeways and mounds visited by him.

In the third part of the paper the author refers to the tribes to which belonged the aborigines who peopled the states of Portuguesa and Zamora.

The paper, which is accompanied by lists of works consulted, contains a series of photographs and a map of regions in which the explorations were made.

Jade in Brazil: Antonio Carlos Simoens da Silva.

The prehistoric art products of jade and of rough jade, all found in the state of Bahia. The locality where these art products, in a certain abundance, and the rough material have been found, suggesting their existence in various beds. The variety of very hard rocks, their existence, accompanying the jade. Explorations made by the writer and trustworthy opinions on the subject given by the inhabitants, some of them differing from those presented by Mr. Ehristovam Barreto. The analysis and the specific weight of this green rock and its pretended curative property. The opinion of the Brazilian inland people about these art products.

The Grindstones of the Primitive Inhabitants of Cabo Frio, Brazil: Antonio Carlos Simoens da Silva.

Some of the Indian tribes who inhabited formerly, by preference, the coast regions of Brazil. Their permanence in the old captaincy of "São Thome," to-day state of Rio de Janeiro. Their large grindstones in "Cabo Frio," county of this Brazilian state, where they prepared their arms and utensils. The accurate study of ten of these granite blocks, their measurements and their grooves.

References to the other class of Indian grindstones, named "shingles," which they carried with them.

The Alaculufs and Yahgans, the World's Southernmost Inhabitants: Charles Wellington Furlong.

The Fuegian Archipelago lying south of the Strait of Magellan and the Patagonian Archipelago, lying north of it, is a grand, desolate region with precipitous shores covered mostly with rain-soaked bog and impenetrable forests. We find among the four primitive tribes occupying it, two which are canoe peoples, the Alaculufs to the west and north, the Yahgans to the east and south.

The names of both these tribes having been made authoritative by the Rev. Thomas Bridges, the nomenclature of these regions indicates much of its history.

The Fuegian tribes were probably pushed south by stronger northern tribes, the canoe people down the Patagonian channels, the foot people of northern Tierra del Fuego and Patagonia down the Pampas of the latter territory. The Andes and the Strait of Magellan prevented communication between the various tribes and may have been responsible, in part or in whole, for the difference in their languages.

The Yahgan language (Yatigan) was found by the Rev. Thomas Bridges, who wrote a remarkable Anglo-Yatigan dictionary and grammar to consist of at least 40,000 words. This will stand as the greatest piece of linguistic work ever done in connection with these people.

Of the Alaculufs little is known. No white man, as far as is known, has ever spoken their language. They formerly seemed the most numerous of the Fuegian tribes. Now they are fast disappearing.

The Yahgans are the southernmost people in the world. Their environment made them canoe people and forced them to a nitrogenous diet through limited food supply; it also made them nomadic, in consequence preventing them from establishing large or permanent communities and from developing a tribal authority or any form of tribal government. Consequently they are socialistic. This lack of gregariousness has probably affected their religion, which is more or less animistic and without any form of worship. They are without chiefs or gods.

Many kitchen middens composed mostly of heaps of débris show their village sites. In one of these I found the world's most southern "perforated stone" with knobby projections. It is now in the American Museum of Natural History. The exhuming and study of these should be undertaken systematically.

The Yahgan's stunted stature may be accounted for by his squatting in canoes. Young Yahgan men of the present generation who have lived on land, herding sheep for a missionary rancher, are well proportioned.

The gap between primitive and civilized man I believe to be very narrow. The white man's contact with the Alaculufs and Yahgans has been their undoing, particularly through the forcing of clothes upon them, cutting their hair, and the introduction of syphilis and various venereal diseases; measles, whooping cough and smallpox have swept them off like a plague.

The Yahgans have decreased in 46 years from about 2,500 to about 100. There still remains important scientific work to be done among these people, but whatever is done must be done soon.

The Tribes of the Fuegian Archipelago: CHARLES WELLINGTON FURLONG.

The Fuegian Archipelago—its nomenclature—its autochthonous inhabitants, and their linguistic divisions. The four tribes—the Alaculuf, Yahgan, Haush and Ona. Geographical distribution of these tribes. Origin of their tribal names. Brief consideration of their languages. Proto-history and history. Their environment, its effect on their distribution, physique, language and social organization. The effect of food on their social organization. The number of present and past aboriginal populations of the Fuegian archipelago. The effect of white civilization on the Fuegians, showing causes and effects.

Fuegian and Chonoan Tribal Relations: JOHN M. COOPER.

The Fuegian archipelago is inhabited by three distinct tribes—the Onas of Tierra del Fuego, the Yahgans of Beagle Channel and the southern islands, and the Alacalufs of the remaining territory. The three tribes speak languages that are lexically at least quite distinct, while from the physical and cultural standpoints the Yahgans and Alacalufs agree much more closely with each other than with the Onas.

The Onas show Tehuelchean affinities. They are divided into two subtribes, the Shĭlk'nam and the nearly extinct Mánekenkn, who, though culturally and physically uniform, speak quite different dialects.

A comparison of fifteen available vocabularies and some additional stray words shows with fair clearness that the Alacalufan tongue is spoken by all the non-Yahgan canoe-using Indians of the channels and inlets north and south of the Strait of Magellan, and up the west Patagonian coast as far as Port Grappler or Messier Channel.

The Chonos, now perhaps extinct, spoke a non-Araucanian and non-Tehuelchean language, but whether it was a distinct stock or an Alacalufan dialect is uncertain. Somatologically and culturally the Chonos were closely akin to the modern Alacalufs. Certain cultural elements, including apparently the plank boat, filtrated down the Chilean coast south of Chiloé from Araucanian sources.

The Army Medical Museum and American Anthropology: D. S. Lamb.

The Army Medical Museum at Washington began to receive Indian crania in 1867. In 1868 a circular was sent to medical officers of the army asking for Indian skeletons, crania and "curiosities." The crania received were measured and the results published. By 1877 there were nearly 2,000 crania in the museum. In 1884, in the progress of the study by another officer, a new method of measuring the capacity of the skull was devised, also a craniophore; and composite photographs of skulls were made. In 1887–88 a large number of crania and skeletons were obtained from prehistoric ruins in the valley of the Gila in Arizona. These also were measured and studied, and the results published. Altogether the basis of the several publications consisted of three to four thousand skulls.

The Permanent Teeth, with special reference to American Children: Robert Bennett Bean.

The teeth of the Filipinos appear from one to four years earlier than in American whites; of the French six months to one year earlier; of the American Indians one to six months earlier, and of the Germans six months to two years later.

The great difference between the Filipinos and other peoples is that the canines of the Filipinos erupt much earlier.

The girls are more precocious than the boys, but the difference is not so great among the Filipinos, and is greatest among the whites.

The canines and third molars are undergoing retrograde metamorphosis, as indicated by their size in prehistoric times and to-day. The Filipinos and Indians, in whom the canines and molars erupt early, are more like the prehistoric men than are the Germans and Americans, in whom the canines and molars erupt late.

Hyper-morphism, long head, nose and face and long occiput is a condition (1) of precocity, (2) of unsound teeth, (3) of greater age, (4) of the male sex, (5) of the American white, (6) of development more complete; whereas hypo-morphism, broad head, nose and face and large parietal, is a condition (1) of retardation, (2) of sound teeth, (3) of less age, (4) of the female sex, (5) of the Filipino and (6) of development less complete.

The following supernumerary teeth were seen:

Among 146 Filipino girls, none.
309 German girls, none.
412 American girls, 1 upper and 1 lower incisor.
579 Filipino boys, 2 upper incisors, 1 upper canine.
324 German boys, none.
415 American boys, 1 upper incisor.

Racial Elements in the Modern Population of America: Franz Boas.

Three types may be distinguished among the modern populations of the American continent—those in which the indigenous element forms a high percentage, those with a strong negro admixture, and those derived almost entirely from European sources. In comparison to these, the populations with strong Asiatic affiliations are unimportant. The regions in which the pure aboriginal population forms a large part of the modern population are few and restricted in extent. The political development of American states is very largely dependent upon the prevalence of one or the other of these types of population. The study of these types and the practical questions involved in their composition present a number of important problems. In these populations in which the aboriginal blood predominates or forms a large part the effects of racial mixture must be studied.

In all these regions the mixture proceeds in both directions, marriages between native men and European women and vice versa being of nearly equal frequency. Material for answering the biological questions involved is very inadequate. It has been shown that in the United States the physical development of the half-bloods is superior to that of the parental types, and that the fertility of the half-blood women is greater than that of women of pure race. The claim has been made that racial traits of the Indians and of the whites are inherited according to Mendelian laws; but no adequate proof of this contention can be given. In those regions in which there is a strong infusion of negro blood, conditions differ considerably in Latin America and in Anglo-Saxon America. In the former regions marriages between men and women of the two races are almost equally frequent. In the latter region marriages between white men and negro women form the vast majority. These conditions have a far-reaching influence upon the development of the resulting population. In the former case a permeation of the two races results in a mixed type, with almost equal amount of blood contributed by each side,

in accordance with the number of individuals in each race. In the latter case a constantly increasing amount of white blood will be found, because the fertility of the negro male is materially reduced while that of the white male is considerably increased. For this reason the result of the mixture consists in the development of a population in which white blood will more and more preponderate.

The problems in regions of pure white population are still different. The claim that the amount of mixture of European types that occurs in America is infinitely greater than in corresponding mixture that has occurred in previous times in Europe can not be maintained. Mixture of distinct types owing to migration and intermarriage has been the rule in earlier periods in Europe, and events in America are a repetition on a larger scale of earlier phenomena in the development in European populations. The stability of European social units is largely a phenomenon belonging to the stable agricultural conditions which prevailed until the beginning of the nineteenth century. With the industrial development this stability has been broken. Since conditions in America are quite analogous to those that have prevailed in Europe for several thousand years, there is no reason to assume any detrimental influence owing to the contact of different types in our country.

Heredity of Stature: C. B. DAVENPORT.

The study of the heredity of stature by Galton laid the foundation of biometry and has always been a favorite one for the biometrician who has believed it incapable of Mendelian analysis. Such analysis has, however, been attempted, and, although additional investigations have still to be made on the subject, it is even now clear that stature is not determined merely by general growth factors, but that there are five principal elements that are separately inheritable and form combinations of which the diverse statures of a hybrid family can be in major part explained.

United States Census of Immigrant Stocks: DANIEL FOLKMAR.

In 1910 were presented for the first time in the census figures directly relating to the ethnic composition of the white population of the United States, in so far as that is indicated by the native languages of the foreign born and their children in the United States. A great numerical preponderance is still held by the mother tongues of northwestern Europe. The German is larger than the English or any other single foreign stock in the United States, as thus defined. It contributes more than one fourth of the entire last two generations of immigration. The English-Irish-Scotch-Welsh mother-tongue group numbers 10,037,420, and combined is only about 1,200,000 greater than the German mother-tongue stock.

The "new" immigration from southern and eastern Europe is still a small factor numerically. Taking as 100 per cent. the total white population of the United States in 1910, numbering 81,731,957, the so-called native stock constitutes 60.5 per cent. and the three great linguistic families of foreign stock from northwestern Europe constitute 27.1 per cent., making a total of 87.6 per cent. The elements from southern and eastern Europe constitute, therefore, less than 13 per cent. of the total. Of this, the two principal Latin mother tongues of the United States, the French and the Italian, contribute less than 5 per cent.

Of the total foreign white stock of the United States, 32,243,382, there are 8,817,271 persons who are of German stock. Of the foreign-born white element of the United States, 25.2 per cent. are reported as English, Irish, Scotch, Welsh and Manx in mother tongue and 21.8 per cent. are reported for the Germanic languages. Russian immigration is shown to be far more Hebrew (52.3 per cent.) than Russian (2.5 per cent.) or even Slavic.

The Spanish mother tongue contributes a much larger proportion of the total foreign-born white element than does the corresponding country of birth, Spain. The excess comes mainly from Mexico and other countries south of the United States. South America shows a decrease in the number reporting Spanish its principal mother tongue as represented in the United States. The contingent from Cuba is over 95 per cent. Latin—that is, mainly Spanish—while the representation in the United States from the other West Indies is, on the contrary, over 70 per cent. English, less than 10 per cent. being Latin.

Anthropological Study of Old Americans: ALEŠ HRDLIČKA.

Old Americans, for the purpose of this study, are those whose parents and all four of whose grandparents were born within the territory of the United States and have no colored admixture.

Physical and to some extent also physiological investigations on this now very numerous, and at the same time rapidly diminishing, stock have

been carried on by the writer now for three years. The object of these investigations is twofold. In the first place they are expected to show what, if any, bodily and functional changes have taken place in the descendants of early whites under prolonged action of American environment; and, in the second place, they are to give us a series of much-needed standards, for use in anthropological comparisons.

The study is limited to healthy adults between 24 and 60 years of age, and no selection whatever is made beyond this requirement; in fact the work is purposely confined to the District of Columbia, where the old American population is derived from all vocations and from all parts of the country. The number of individuals of each sex to be examined was set at from 150 to 200, and the lower limit has now been nearly reached with both males and females.

The results of the research are most interesting. In general, it may be said that no homogeneous American type exists, even in the very oldest families; ancestral traits often persist in a remarkable manner; yet on the whole there are unquestionable evidences of a tendency towards the formation of a purely American subtype. In other words, there are evident, on the one hand, the power and persistence of heredity, while, on the other hand, we can also trace the effects of local American acquisitions. Yet there is little probability that a national type will develop in this country within the next few centuries; the old families are dying out or mixing with newcomers, and immigration will keep on pouring in fresh foreign strains. Even should immigration stop, there is little probability that a single American type would ever develop, but we should expect rather several subtypes, due to the basic regional differences in the components of the population, jointly with differences in environment.

The Genesis of the American Indian: Aleš Hrdlička.

The author of this paper considers the question of the unity or plurality of the American race. In answering this question he decides in favor of the original unity of the Indian race in America. He bases his conclusion upon the similarities of language, culture, mentality and physique. The author next takes up the question of the antiquity of the race on this continent. He does not think that the Indian was autocthonous on this continent. He bases this belief upon the absence of the inferior primates of the anthropoid type on this continent, also upon the subject of the unity of the human species and upon the circumstances that the primitive types of humanity living in Europe during the quaternary or glacial epoch could not have come from America. According to the author no human remains of geological antiquity have been demonstrated to exist on this continent.

The third question considered is the source of the elements that occupy America and the epoch of the occupation.

With respect to the first point the author passes in review the means of transportation of prehistoric man. The geographical situation of America with respect to the other continents; the anthropological characteristics of the American Indian, which compare with the primitive characteristics of the great ethnic groups of other parts of the world. The author concludes from these considerations that the American aborigines could have come only from Asia.

With respect to the epoch, the author thinks that no direct proof exists upon which to base an opinion. Considerations or proofs of an indirect character tend toward the idea that emigration to America could not have been effected before the European Neolithic period.

The manner or manners of the arrival of man to the new world and his subsequent dissemination and reproduction there constitutes the last point of analysis by the author. His opinion is that there was not one but many successive immigrations.

Variations in the Lambda of the Crania of the Ancient Peruvians: Carlos Morales Macedo.

In the limited zone between the two occipito-parietal sutures and in the lambda itself, there are observed certain morphological variations, which present in the crania of the ancient races of Peru a frequency not surpassed in the crania of other peoples. The author is of the opinion that in the lambdoid region the Peruvian crania show an anatomical peculiarity.

The interparietal, the epactal and the lambdoids are treated separately. The study is based on the observation of 924 authenticated Peruvian crania, of which 551 belong to the National Museum of Peru, 102 to the Raimondi Museum (School of Medicine), Lima. The remaining 271 were collected by the author in the ruins of Pachacamac and the huacas of Ancon.

The author's conclusions are:

The interparietal is found in 2.7 per cent. of Peruvian crania, which is somewhat higher than in non-Peruvian crania. The crania from Pachacamac, Ancon, Lima, etc., and those from the coast region in general show this anomaly with greater frequency than crania from other regions of Peru.

The wormian lambdoids are present in 56.2 per cent. of Peruvian crania. In the other 43.8 per cent., the lambdoid suture is frequently very complicated. It is possible that the presence of wormian lambdoids in Peruvian crania may have been favored by cranial deformation. The wormian bones of the saggital, coronal, squamose and occipitomastoid sutures exist in the crania of Peru approximately equal to that of the crania of other countries.

With regard to the epactal, he draws the following conclusions: (1) The epactal is present in 21.6 per cent. of Peruvian crania, which is a much higher proportion than in other crania. (2) In crania of genuine Aimara origin, the epactal appears with less frequency than in the crania of other Peruvian origin. (3) It is possible that the greater frequency of the epactal in Peruvian crania may have had for cause the deformation of infantile crania. The deformation would disturb the nutrition of the bone, weakening the tissue of the occipital; such a trophic change would be transmitted through heredity in the form of a predisposition to anomalies in the lambdoidal region.

Trepanation of the Cranium and its Representation in Pottery of Peru: CARLOS MORALES MACEDO.

The evident antiquity of trepanned crania leads to the belief that this was the first operation of major surgery practised by ancient man. Ancient Peru was the place where the art of trepanning was cultivated on the largest scale. From the ancient cemeteries of this country were obtained the greater part of the crania that show trepanation, found to-day in the museums of America and Europe. The most interesting and complete collection among these is the one which Dr. Julio Tello obtained in the canyon of Huarochiri and which Dr. Aleš Hrdlička exhibited recently in San Diego, Cal. The ancient Peruvians have not left us many data with respect to the practise of trepanning the cranium. This is due perhaps to the fact that trepanation was at its height when the ceramic art was but little advanced and to the fact that the Aimara Indians did not cultivate to any high degree the plastic arts. The author has found in a cemetery of Casma a piece of pottery which represents the act of trepanation, which may be described as belonging to the most ancient and imperfect epoch of the ceramic art of Chimu.

The piece of pottery referred to is of a black color, of medium size, and belongs to the class called "silvadores" (whistlers). On one side there is a figure of a man seated with a human head between the legs. With the left hand he is holding the head in position, while with the right he is using a heavy instrument apparently of stone. This instrument is of a length somewhat greater than the width of the head and terminates in a sharp curved edge in the form of a half moon.

Artificial Deformation of the Cranium in Ancient Peru: CARLOS MORALES MACEDO.

This paper on the practise of cranial deformation among the ancient inhabitants of Peru contains several chapters. The first treats of similar deformations among other ancient peoples. The second gives an account of the existence of those operations in Peru during the pre-Columbian epoch. The third relates what the early chroniclers had to say on the subject. The fourth is a study of ceramic art in this connection. The fifth treats of the origin and antiquity of the operation in Peru. The sixth gives a morphological classification of deformed crania in Peru. The seventh and eighth study two forms of deformation. The ninth analyzes the asymmetry of deformed crania. The tenth describes methods employed for deforming the head of the child. The eleventh considers the duration of the compression. The twelfth discusses the motives which inspired the deformation. The thirteenth gives the conditions of the infantile cranium which facilitates the deformation. The fourteenth treats of a mechanical process of the deformation. The fifteenth treats of the effect on health produced by the deformation. The sixteenth reviews the physiological effects and the seventeenth and last considers the question of the inheritance of cranial deformations.

The Fossil Man of Cuba: LOUIS MONTANÉ.

A young priest of Tunas de Sancti Spiritus, Cuba, discovered in 1884 in the mountains of Banao a primitive burial ground, from which Dr. J. F. Torralba received in the same year a small box of fragments of bones. This place, known by the name of Gruta del Burial, was studied by Dr. Montané. It consists of a cavern 7.50 meters long, 4.50 deep, and at its entrance 10 meters high.

According to Dr. P. Saterain, who made a geological study of the cavern, it is of the same calcareous composition as the mountains in which it is situated. It has not been possible to determine the age of the cavern because there were no fossils in it; and the inclination of from 60° to 70° of the calcareous strata, the tertiary strata visible in slopes of the mountain, and other circumstances permit the conclusion that in geological formation it belongs to the secondary and probably to the Jurassic period.

In the bottom of the cavern, resting on a layer of ashes, there were found a number of skulls arranged in a semicircle, and concentric to those, the large bones arranged in the form of an X, and in the same way the short and flat bones were arranged, and at the center the bones of the pelvis. Three of the skulls were studied in Paris under the direction of Drs. Verneau and Rivet in 1906.

In the cave was found also the fragments of a human mandible and a flat stone; and mixed with human teeth a number of other teeth of a strange form. The objects mentioned will be placed on exhibition for the benefit of the members of the congress. The fragment of the human mandible was studied in 1911 by F. Ameghino, who believes that it belonged to a species of genus homo different from those known up to the present time. He gave it the name of *Homo cubensio*. In the opinion of Dr. Roth, of the Museo de la Plata, the mandible and the teeth are those of a species of ape extinct in the island of Cuba, where in historic times apes have not been known.

The study of Dr. Montané is accompanied by an extensive bibliography.

Indian Ceremonial and other Practises on the Human Body: Walter Hough.

Practises on the human body are almost universal, such as tattoo, perforation of lips, nose, cheeks, ears, breasts, etc.; filing, breaking or ornamenting the teeth; shaping the skull, nose, legs, etc.; excoriations by knife and fire, etc. They may be classified as (1) surgical, (2) cosmetic, (3) ceremonial, and (4) thaumaturgic practises, and cause more or less profound modifications in parts of the body. It is probable that they are all based on nature religion. Environment has an important effect on the practises treated in the paper. The majority of mutilative practises occur among unclothed peoples. In America they are found sparingly in the United States and become increasingly prevalent in Mexico, Central America and tropical South America, repeating the phenomena of the East Indies, Oceanica, Africa and such regions as are inhabited by unclothed peoples. Among clothed peoples the visible parts of the body are subject to modifications in the following order: Ears, nose, lips, facial surface and ankles. The practises on these parts survive the adoption of clothing, while tattoo deteriorates or becomes obsolete. The paper describes American practises and illustrates the practises of other parts of the world for comparison.

Preliminary Remarks on the Skeletal Material Collected by the Jesup Expedition: Bruno Oetteking.

In preliminary remarks on the skeletal material collected by the Jesup Expedition of the American Museum of Natural History, the speaker points out the variety of racial elements combined in the Indian population of the northwestern section of this continent. So far as the skulls are concerned, the morphological diagnosis of the face will aid materially in conducting investigations. Racial affinities with the peoples of northeastern Asia can be demonstrated in consideration of the bodily proportions manifested in the size and form of the long bones.

One Aspect of Present Evolution in Man: Paul Popenoe.

Pre-Columbian America was free from the most serious contagious diseases of Europe: tuberculosis, smallpox, measles, etc.; consequently the native population had undergone no evolution or immunization against them. When brought by the conquerors, these diseases immediately began to kill the natives much more rapidly than they did the Europeans, among whom natural selection, by eliminating the least resistant in each generation for many centuries, had produced a strong resistance. In the markedly different death-rate of native Americans and Europeans, with respect to these European diseases, we can see evolution in man actually in operation, and working rapidly to produce a more disease-resistant race in the New World. The high death-rate of negroes in the United States from tuberculosis, as contrasted with the death-rate of whites, offers another illustration of natural selection at work. In the light of such facts, it would be erroneous to suppose that evolution in man has slowed down or ceased; in some directions it is probably proceeding more rapidly to-day than ever before.

George Grant MacCurdy

(To be concluded)